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THE REALITIES OF EXPERIENCE.

GREAT IN MANY WAYS, Huxley was perhaps greatest as an essayist. To this end he applied three conspicuous gifts, —an eye for essentials, lucidity of thought, and style. Original research had provided him with a solid basis of first-hand knowledge in his special branch of science. Wide reading and a tenacious memory furnished him with abundant material for apt and forcible illustration. He knew the public whom he addressed and felt its pulse with admirable skill. He had a mission and a message. He stood forth as the champion of science and of a negative philosophy founded thereon. It is one aspect of that philosophy I propose to consider.

Towards the close of the essay on Descartes's *Discourse on Method* Huxley said:[1]

"The reconciliation of physics and metaphysics lies in the acknowledgment of faults upon both sides; in the confession by physics that all the phenomena of nature are in their ultimate analysis known to us only as facts of consciousness; in the admission by metaphysics that the facts of consciousness are, practically, interpretable only by the methods and the formulæ of physics; and, finally, in the observance by both metaphysical and physical thinkers of Descartes's maxim—assent to no proposition the matter of which is not so clear and distinct that it cannot be doubted."

In two subsequent essays, and elsewhere incidentally, Huxley interpreted and fully accepted the Berkeleyan analysis of sensation

[1] *Collected Essays*, I. p. 194.

and perception. Starting with the prick of a pin, which subtly transforms itself on the next page into a needle, and passing to the smell, taste, and visible appearance of the orange, without which, as part of his stock in trade, no one who has a due respect for tradition would attempt to deal with the problem, he leads up to the position which Locke thus summarised:[1]

"Flame is denominated hot and light; snow, white and cold; and manna, white and sweet, from the ideas they produce in us; which qualities are commonly thought to be the same in these bodies that those ideas are in us; the one the perfect resemblance of the other as they are in a mirror; and it would by most men be judged very extravagant if one should say otherwise. And yet, he that will consider that the same fire that at one distance produces in us the sensation of warmth, does at a nearer approach produce in us the far different sensation of pain, ought to bethink himself what reason he has to say that his idea of warmth which was produced in him by the fire, is actually in the fire; and his idea of pain which the same fire produced in him in the same way, is not in the fire. Why are whiteness and coldness in snow, and pain not, when it produces the one and the other idea in us; and can do neither but by the bulk, figure, number, and motion of its solid parts?"

Having thus, in company with Locke, disposed of any claim to external reality which these so-called "secondary qualities" may be supposed to possess, Huxley then proceeds to apply the Berkeleyan logic to the "primary qualities." Locke had said:[2]

"The particular bulk, number, figure, and motion of the parts of fire and snow are really in them, whether any one's senses perceives them or not, and therefore they may be called real qualities because they really exist in those bodies; but light, heat, whiteness or coldness are no more really in them than sickness or pain is in manna. Take away the sensation of them; let not the eyes see light or colors, nor the ears hear sounds; let the palate not taste nor the nose smell; and all colors, tastes, odors, and sounds, as they are such particular ideas, vanish and cease, and are reduced to their causes, i. e., bulk, figure, and motion of parts."

But as Huxley, interpreting Berkeley, goes on to show, a rigorous extension of the logic which disposes of the secondary qualities, forces us to admit that the primary qualities are in like condemnation. So that the final upshot is this:

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[1] Quoted in *Collected Essays*, Vol. VI. pp. 253–254.

[2] Quoted Vol. VI. p. 255.

"If the materialist affirms that the universe and all its phenomena are resolvable into matter and motion, Berkeley replies: 'True; but what you call matter and motion are known to us only as forms of consciousness; their being is to be conceived or known; and the existence of a state of consciousness, apart from a thinking mind, is a contradiction in terms.' (P. 279.)

"Our sensations, our pleasures, our pains, and the relations of them make up the sum total of positive, unquestionable knowledge. We call a large section of these sensations and their relations matter and motion; the rest we term mind and thinking; and experience shows that there is a constant order of succession between some of the former and some of the latter." (P. 318.)

Now, when having closed the book and looking up, one sees a bunch of purple violets, delicately formed, sweetly scented, in the vase out there on the table, one is tempted to wonder whether, in following the lead of Locke and Berkeley, the high priest, or if it be preferred the proctor, of modern science, took the line most suitable for the end he had in view. That end was first the delimitation of scientific knowledge, and secondly the disclosure of the foundations on which that knowledge is securely based. Both the range and the basis may be summarised, on the principles he adopts, in the single word Experience. Beyond experience we are not to stray; and the clear teachings of experience we are to trust with absolute confidence.

"The memorable service rendered to the cause of sound thinking by Descartes,' said Huxley, "consisted in this: that he laid the foundation of modern philosophical criticism by his inquiry into the nature of certainty. It is a clear result of the investigation started by Descartes, that there is one thing of which no doubt can be entertained, for he who should pretend to doubt it would thereby prove its existence; and that is the momentary consciousness we call a present thought or feeling; that is safe, even if all other kinds of certainty are merely more or less probable inferences." (VI. 63, 6.)

For my own part I confess that when, having closed the book, or awakened from the metaphysical reverie it has suggested, I see before me the bunch of violets, nothing in the whole range of my experience appears to be more certain and clear than the reality *in all its details*, of this present item of immediate perception. If I am to accept the Cartesian maxim, here and now is my opportunity. Suppose that a physicist at my side undertakes to show that

what I call the color of the violets is explicable in terms of matter and motion; I listen with respectful attention. But, granting that every step of his argument conforms strictly to the Cartesian canon, it is none the less true that every step takes us farther from the particular reality of immediate experience from which we started. No doubt, our path may lead us to new realities of physical thought and inference. That I do not deny; what I deny is that our journeying from the Land's End to Berwick-on-Tweed has altered one whit the reality of our experiences at the outset of our journey. And if the mental philosopher then offers to be my guide through the country of Hume, I am delighted to be his companion right up to John o' Groat's. I rejoice to travel in such excellent company. But when we get there, when not only the Land's End violets but the matter and motion of Berwick have faded in the indefinite distance, and become but pleasant memories, it appears to me that though we have taken many more steps and journeyed further from our starting-point, and though what we see at John o' Groat's (with a good pair of metaphysical spectacles) may be quite clear and real, yet,—there is our bunch of violets on the table. We have passed from the realities of immediate perception to the realities of physics and thence to the realities of Berkeleyan thought: but don't try and persuade us that these realities of abstraction carry with them more certitude than the immediate experience with which we started. I profess that, being but a plain man, the reality of my experience, as I look at the bunch of violets, carries with it the very maximum of conviction. And it appears to me that, on the principles of Descartes's himself, we should substitute for his celebrated *Cogito ergo sum*, concerning which as it stands very pretty arguments have arisen, the indisputable axiom *Experientia est.*

There are some, however, who would seek to undermine the foundations of this belief. Mr. Balfour, for example, interprets the teaching of Naturalism as follows:

"Whereas common sense tells us that our experience of objects provides us with a knowledge of their nature which so far as it goes, is immediate and direct, science informs us that each particular experience is itself but the final link in a long chain of causes and effects, whose beginning is lost amid the complexities of

the material world, and whose ending is a change of some sort in the mind of the percipient. It informs us further, that among these innumerable causes, the thing 'immediately experienced' is but one; and is, moreover, one separated from the 'immediate experience' which it modestly assists in producing by a very large number of intermediate causes which are never experienced at all. . . . The fact that even the most immediate experiences carry with them no inherent guarantee of their veracity is, however, by far the smallest of the difficulties which emerge from a comparison of the causal movement from object to perception, with the cognitive leap from perception to object. . . . For we need only to consider carefully our perceptions regarded as psychological results, in order to see that, regarded as sources of information, they are not merely occasionally inaccurate, but habitually mendacious. We are dealing, recollect, with a theory of science according to which the ultimate stress of scientific proof is thrown wholly upon our immediate perceptions of objects. But nine-tenths of our immediate experiences of objects are visual; and all visual experiences, without exception, are, according to science, erroneous. As everybody knows, color is not a property of the thing seen: it is a sensation produced in us by that thing. The thing itself consists of uncolored particles, which become visible solely in consequence of their power of either producing or reflecting ethereal undulations. The degrees of brightness and the qualities of color perceived in the thing, and in virtue of which alone any visual perception of the thing is possible, are therefore according to optics, no part of its reality, but are feelings produced in the mind of the percipient by the complex movements of material molecules, possessing mass and extension, but to which it is not only incorrect but unmeaning to attribute brightness or color."[1]

Mr. Balfour would seem to have written this near Berwick-on-Tweed. But we must remember that he is merely interpreting what he assumes to be the creed of science. According to this creed, thus interpreted, our experiences at the Land's end were naught but an illusory dream. I refuse to admit the physical scenery of this interpretation, real enough in its proper place, as a substitute for the equally real scenery of direct perception. The Land's end of immediate experience from which Mr. Balfour starts is a green tree standing in the next field. And I claim that this green tree is not a whit less real than "the complex movements of material molecules, possessing mass and extension" which come into view at Berwick. We are not dealing at present, remember, with any of the inferences which may be drawn from the original expe-

[1] *Foundations of Belief*, pp. 108, 111, 112.

rience,—with any judgment about the object. These may be true or false without affecting one jot the reality of the experience as such. We are not regarding the experience as a message. It may be true that, as Mr. Balfour says:

"Anything which would distribute similar green rays on the retina of the eyes in the same pattern as that produced by the tree, or anything that would produce a like modification of the cerebral tissues, would give an experience in itself quite indistinguishable from the experience of the tree, although it [nay, Sir, not it but our interpretation of it] has the unfortunate peculiarity of being wholly incorrect The same message would be delivered, in the same terms and on the same authority, but it would be false."

Be it true or false, however, as a message,—as an experience it is unquestionably real. We either have it or do not. If we have it, it is real in the only intelligible meaning of this much abused word as applied in the affairs of practical life. We have established our asylums for those whose terribly real experiences habitually deliver false messages, that is to say messages which are for you and me and other normal people unverifiable and incorrect. It is of course open to some one to elaborate the thesis that we are all mad, and that this world in which we live is a glorified Bedlam. If so all we can do is to clap him into an asylum for the sane, and treat him kindly. It is on the validity of normal experience that we must take our stand.

Perhaps it may seem somewhat arbitrary to select certain experience, label it normal, and assert that it is on this selected reality that we must take our stand. The distinction, however, is between reality and validity. All experience, normal and abnormal alike, is real; but it is not all of the same social validity. If a lad come in on a dark night with blanched cheeks and trembling limbs saying that he has seen a ghost in the lane, his experience was real —appallingly real—but it lacks social validity. He stoutly contends that if you dare face it you too will see the spectre standing by the bank. Curiosity impels you to go; and you find a sheet of the *Daily Telegraph* blown by the wind against the hedge. The experience was real, but it was falsely interpreted. The dagger Macbeth saw was for him as real as immediate experience could make

it: but the phantom of his overwrought brain had no social validity, since for others there was but vacant air. The value of experience is as the guide to action. It generates anticipations; and only in so far as these anticipations are verifiable by others is it not only real but valid.

This leads us on to our next point. What is true of *an* immediate experience is true of any given series. Their reality lies in their being experienced. There is the tree in yonder green field. If I walk to it, touch it, inhale the fragrance of its blossoms, or, later in the season, enjoy the flavor of its fruit; if I run a splinter from it into my finger, or foolishly knock my head against its boughs; if I measure its height or calculate its value; in all of this there is a sequence of experiences, each of which is real for me just in so far as it is an actual experience. And we are able to guide our actions and walk more or less sure-footedly in the paths of experience, just because, as experience itself shows, the realm we have been exploring is an orderly realm,—orderly not only for me but for you. For you and I can compare notes as to our experience, whence emerges natural knowledge.

All of this seems, no doubt, to many very elementary and trite. We know perfectly well, it may be said, that out there in the field is a tree; that if one is near enough one can see it, and if one goes still nearer one can handle it and taste its fruits. There is no need to tell us that the orderly sequence of experience is the result of two quite independent things,—our consciousness and the tree. That is mere common sense. But it must be remembered that common sense is a subtle compound of practical experience and crude metaphysics. The assumption that the unity of experience is the product of two independent factors, the tree and consciousness, is a metaphysical assumption, and one which leads to all sorts of difficulties. It forces you to divide the experience between the two existences. You will perhaps begin, with Locke, by admitting that the color, and the sweetness, and the pain are in your consciousness, while matter and extension are in the tree. Then you may be perplexed, like readers of Huxley, with horrid doubts about the matter and extension as they exist independently

of the percipient mind. And you may end with the conviction that "what we are conscious of as properties of matter, even down to its weight and resistance, are but subjective affections produced by objective agencies which are unknown and unknowable;" and may be enfolded at last with the lambs that Mr. Herbert Spencer feeds with the metaphysical grass of transfigured Realism. Which Heaven forbid! for the unknowable is innutritious provender.

But surely, the tree as object and the mind as subject are distinguishable with Cartesian clearness. Distinguishable, yes—like the scent and color of my violets. But it does not follow that they are separable. In experience they are inseparable; and if we postulate independence, we do so on metaphysical grounds. Let us go back to the immediate experience which I describe as a green tree in the field. This is our starting point. Now what we do is to analyse this bit of practical experience. And as the result of our analysis we distinguish in thought what philosophers have agreed to call an objective aspect, the green tree, and a subjective aspect, our perception. In experience the two are inseparable. And a system of science which is founded on experience should frankly accept its limitations and leave outstanding problems to metaphysics. If we do this; if we hold firmly, as students of science, to the teachings of experience and refuse, within the sphere of science, to go beyond them; if we be careful to avoid the pernicious fallacy, that what is distinguishable in analysis is necessarily separable in existence; then our way is comparatively clear and simple. Looking at our experience in its objective bearings, we elaborate a system of natural and physical science; looking at it in its subjective bearings, we elaborate a co-ordinate system of mental science. The question whether the color is in the tree or in our mind, admits of no answer from science, just because it is wrongly stated. It is formulated in terms of the crude dualistic metaphysics of common sense. Asked in an intelligible form for science, it admits of a perfectly intelligible answer. The color is certainly part of the objective aspect of vision and has to be investigated by natural and physical science; it, as unquestionably, has a bearing on the subjective interpretation of experience, and from this point of

view falls within the province of the psychologist. The distance of the tree, its size, its value, fall, in like manner, within the scheme of objective interpretation, from one point of view, and within the scheme of subjective interpretation from the other; and that because as items of experience they are susceptible of this mode of analysis.

For science both aspects, objective and subjective, are absolutely co-equal and co-ordinate in the matter of reality. It is just as absurd to deny objective reality as to deny the reality of experience; the one implies the other. Science, I repeat, takes its stand on this reality of experience; polarises it under the magnetic influence of thought; terms all that falls within the objective purview the natural and physical universe, and all that falls under the subjective analysis the world of mind; regarding both as co-ordinate realities, or, rather, coequal aspects of the basal reality of experience.

But it may be said that the immediate experience of the bunch of violets, or the green tree in the field, carries with it the ineradicable conviction that the object is independent of the subject. In what sense independent? If we cross-question practical experience, apart from the metaphysics of common sense, does it assert with conviction anything beyond the range of actual or possible observation or of verifiable inference founded thereon? I cannot discover that it does. Experience begets expectations, and the reiterated verification of such expectations does carry with it a sort of conviction. I am convinced that if I reach forth my hand to the violets and carry them to my nose, I shall experience their fragrance. I do not wish in any degree to minimise the force and value of such convictions. They are our guides in the practical conduct of life. Without them we could make no advances in science. At the same time these expectations *may be* misleading. The violets may be artificial and have been placed on my table as a practical joke. Or they may be dog-violets. The order of certainty—if the expression be allowed—of the immediate experience, as such, is different from that of any expectation, no matter how well founded. *Experientia*

erit cannot be asserted with the same absolute confidence as *Experientia est.*

Now, so far as I can ascertain, practical knowledge, apart from metaphysics, never goes beyond the assertion that experience, actual or possible, is, was, or will be, of such and such a kind. It asserts on the evidence of Geology that *Ichthyosauri* lived in the seas of Liassic times, and that, had men been living then, there would have been such and such experiences. It asserts that in the experience of the future, as in that of to-day, sunrise and sunset will continue so long as the solar system shall endure. All past history, all anticipations for the future, it presents in the form of actual or possible experience. But if we ask questions which do not admit of answers couched in terms of experience, inquiring, for example, what will be the state of matters if experience, actual or possible, is from the nature of the case excluded, then common sense either refuses to give any reply, or has resort to metaphysical assumptions. It is apt to assume, for instance, that because *my* experience, say of the bunch of violets, is independent of you, and *yours* of me, and *ours* of some actual or possible third person, the object, as such, is independent of *any* experience. That there may be something independent of any experience, I am not concerned here either to assert or to deny. Such assertion or denial must be based on metaphysical grounds altogether beyond the domain of actual observation. For the practical affairs of life the word "object" indicates that which is given in sensory experience. Begotten thus of experience, the object should resent any doubts which may be thrown on its legitimate parentage. I cannot believe that common sense ever seriously means to cast this slur on the objects of perception. It asserts that under given conditions of experience you or I, or any one else, may see and handle the violets—that as objects they are independent of any of us severally, not surely that they exist, as such, independently of all experience.

But is not this complete independence implied in our words and forms of speech? Not necessarily. The function of language is to enable us to communicate to each other, or to record, the results of experience and of thought. Their implications are either

practical or metaphysical. Absolute independence is a metaphysical implication, and differs from that practical independence which is a matter of common experience. If some one tells me that there are mile-stones on the Dover road, and that if I care to journey thither I shall see them, he expresses first a fact of experience, and secondly an anticipation based thereon. It is true that I or any one else can verify my informant's anticipation. This shows that the object is independent of merely individual experience, but it does not show, nor does our language necessarily imply, that, as objects, the mile-stones are independent of all experience. And if it be said that some thing, at any rate, does exist independently which generates or is the occasion of the several experiences of those who journey along the Dover road, I am certainly not prepared to deny the statement; but it belongs to the domain of metaphysics, not to that of practical knowledge. To the question, What is the cause of the experience in which you trust? practical knowledge, apart from metaphysics, replies: That is outside my province. What information I have is entirely based on observation. I can offer no opinion on matters which lie behind and beyond it.

I conceive that science, in so far as it is founded on practical experience, should make precisely the same answer. No doubt science has carried its inferences much further afield. It deals in greater degree with generalisations and employs more largely the symbolism of abstraction. It soars on the wings of thought to more lofty and difficult heights. For it must not be forgotten that the realm of experience includes not only the domain of the senses, but all that can logically, with the Cartesian canon in view, be founded thereon.

"Indeed the domain of the senses," as Tyndall said, "is almost infinitely small in comparison with the vast region accessible to thought which lies beyond them. From a few observations of a comet when it comes within the range of his telescope, an astronomer can calculate its path in regions which no telescope can reach; and in like manner, by means of data furnished in the narrow world of the senses, we make ourselves at home in other and wider worlds, which can be traversed by the intellect alone."

Just as the trigonometrical survey of a whole continent may be constructed from a single accurately measured base-line, so may we construct the vast extra-sensible world of science from the accurately measured base-line of sensible experience. Science does but indefinitely prolong and extend the process of inference which common sense habitually employs in dealing with daily affairs. And only by oft-repeated reference to the touchstone of experience is the gold of valid inference distinguishable from the false coinage and spurious notes of fallacy.

There is, however, another feature of scientific knowledge which is perhaps more frequently overlooked. It is founded on selected experience. Although from the subjective aspect abnormal experience forms an important field for investigation, yet, in its objective aspect, science is forced to exclude it altogether. And not only is abnormal experience necessarily ignored (for it has no social validity), but all observations which fail to reach the standard of accuracy and exactness which science imposes, are for that reason excluded. There is also a tendency, wise in the main but apt to be arbitrary, to deny the validity of all such experience as fails to conform to the existing conclusions of science—to ignore whatsoever seems to be discordant with our scheme of scientific interpretation. This may perhaps be regarded as the besetting intellectual sin of the narrow-minded devotee of science. It is a defect which time and increased wisdom will remedy. The ideal towards which we work should be that all sane and accurate experience shall find its appropriate place in the system of scientific knowledge.

The result, then, of the analysis of this extended system founded and built on experience, is to polarise it into objective and subjective, one in essence but diverse in aspect, of neither of which do we know anything apart from the other, both of strictly co-ordinate reality within the system. Under the objective aspect we classify all that we learn from astronomy, geology, biology, physics, and chemistry, concerning the material universe. The planets of the solar system, the rocks of the carboniferous age, the delicate pencillings on the guinea-fowl's plumage, the chasing on

the minutest diatom, are in no sense less real, for experience, than the orderly molecular or atomic evolutions of which the physicist or the chemist has to tell us. Men of science who are concerned with the objective take for granted the subjective aspect which all experience, as such, must present. That they leave to those whose business it is to deal with our knowledge from this point of view—to the psychologists, who regard the whole realm of experience as that which affords data for the understanding of the orderly sequence of states of consciousnesss. Psychologists take cognisance of the objective, not for its own sake, but as inevitably throwing light on those conscious processes which they have to explain in terms of their special science. Thus by an organised division of labor naturalists and psychologists extend the systematic survey, each from his selected point of view; and thus by analysis are disentangled the strands which constitute the intricately-woven tapestry of human experience; thus, too, in synthetic interpretation, does the student of history, whether of our own times or of a more distant past, utilise all that is rendered visible from each standpoint, and combine actions and motives in one dramatic representation.

Let us, however, in surveying the edifice of human knowledge, be careful not to lose sight of the foundations. These are the common experiences of daily life—the data afforded by observation. Just in so far as these are real and valid, will the superstructure have reality and validity. Any system of thought which conveys the notion that they are tainted with unreality is false to the principles of experience and of science. The corner-stone of the whole building has inscribed upon it the axiom *Experientia est.* If my experience of the bunch of violets be not real and trustworthy down to its minutest and apparently most trivial detail, then there is nothing in the vast system of scientific knowledge which can resist the solvent acid of philosophical scepticism, leaving but the phantom dregs of the Unknowable.

And so we come back to Huxley's line of argument founded on the Berkeleyan analysis. What shall we say of it? Is it true or false? Shall we evade the question and answer indirectly that

it is ill-chosen? Or may we not take refuge in an oxymoron? No one was more desirous than Huxley of doing honor to science. But in these Berkeleyan essays

"His honor rooted in dishonor stood
And faith unfaithful kept him falsely true."

If he wished to make a desert of the Unknowable so that the divine Astræa of philosophic peace should commence her blessed reign, he adopted a strangely ill-advised method of realising his desires. Hear again the words in which he summarises his conclusions:

"Our sensations, our pleasures, our pains, and the relations of these make up the sum total of positive, unquestionable knowledge. We call a large section of these sensations and their relations matter and motion; the rest we term mind and thinking; and experience shows that there is a constant order of succession between some of the former and some of the latter."

I venture to deny the validity of this division into two separate sections, material and mental. The body of experience is one and homogeneous, and *every item* presents to analysis two aspects. But let that pass. The passage is open to a more serious criticism. Bearing in mind the way in which Huxley hunts down the objectivities, hounding first the secondary qualities, and then those once termed primary, until they take refuge in the safe haven of the subjective, is it unjust to paraphrase his conclusions as follows? Only the subjective aspect of experience can make good at the bar of reason its title to reality: the objective universe is at best but an orderly mental phantasmagoria.

Now this conclusion came naturally enough from the lips of a professed mental philosopher like Berkeley. It was indeed a one-sided conclusion. It was elaborated in the subjective field; but it exercised in its own proper sphere no little influence on the development of modern philosophic thought. It established triumphantly the subjective aspect as present in all experience throughout its whole range. And if in its vivid realisation of this aspect it seemed to minimise the value of the correlative objective aspect, the fault may well be condoned—in Berkeley. With Huxley the case is different. What was seemly, nay admissible, in the Bishop

of Cloyne may scarcely befit the proctor of modern science. I have a sincere admiration of Huxley's work and genius. But when, having discoursed with enviable lucidity on the physical basis of life and mind, he finally merges the object in the subject, he is no longer true to the flag of experience under which he professed to serve. The following words are the utterance of a deserter: "If I say that thought is a property of matter, all that I can mean is that actually or possibly the consciousness of extension and that of resistance accompany all other sorts of consciousness." The idealism of the explanation is as absurd as the materialism it professes to explain. Does any true soldier of science believe that his captain here spoke wisely and well? I for one must protest, even if I be drummed out of the service for sowing the seeds of disaffection to a superior officer whose memory is justly revered. But before I am ignominiously stripped of my uniform I must repeat that the objective and the subjective are the co-ordinate products of the analysis of experience, and that the one is as real (and real in precisely the same sense) as the other. If we polarise the experience of a bunch of flowers into objective violets and subjective states of consciousness, we cannot doubt the reality of either without deny-the reality of the experience thus polarised.

And what good purpose, it may be asked, can be served by this discussion? The question at issue is of very little if any practical moment. Notwithstanding all that the Bishop of Cloyne and the philosopher of Ninewells have written, in spite of the arguments of their spiritual progenitor Locke and their nineteenth-century interpreter Huxley, men of science have quietly and steadily pursued their researches, and the general public have accepted and profited by their labors without misgivings. But if we found our knowledge on experience, we must be prepared either to hold Huxley's position or to abandon it and occupy more advantageous ground. No doubt in times of peace we may be content to retain the position in a merely formal manner, without considering its strength or its weakness. It will then afford no little gratification to onlookers when in times of attack the enemy's shot destroy our crumbling walls and force us to beat a retreat. If one may judge from the

comments of the press, this was the attitude of many, when Mr. Balfour opened a vigorous and well-directed fire on what seemed to the field-glasses of the attacking party the chief positions of naturalism.

Choosing his ground with all the skill of a trained dialectician, and selecting for his most concentrated fire a position in itself inherently weak, Mr. Balfour affords to onlookers a view of some very pretty artillery practice:

"Naturalism (as commonly held), he says, is deeply committed to the distinction between the *primary* and the *secondary* qualities of matter; the former (extension, solidity, and so forth) being supposed to exist as they are perceived, while the latter (such as sound and color) are due to the action of the primary qualities upon the sentient organism, and apart from the sentient organism have no independent being." (*Foundations of Belief*, p. 42.)

Then, in the passage already quoted, he argues that, on this view, our perceptions regarded as sources of information, are not merely occasionally inaccurate but habitually mendacious. And a little further on he asks:

"By what possible title can we proclaim the same immediate experience to be right when it testifies to the independent reality of something solid and extended, and to be wrong when it testifies to the independent reality of something illuminated and colored." (P. 113.)

Having captured this position and advanced on one more closely resembling that strengthened and fortified by Huxley, he places a telling shot when he says that—

"It involves a complete divorce between the practice of science and its theory. It is all very well," he continues, "to say that the scientific account of mental physiology in general, and of sense-perception in particular, requires us to hold that what is immediately experienced are mental facts, and that our knowledge of physical facts is but mediate and inferential. Such a conclusion is quite out of harmony with its own premises, since the proposition on which, as a matter of historical verity, science is ultimately founded are not propositions about states of mind, but about material things. . . . So that, if this particular account of the nature of experience be accurate, the system of thought represented by science presents the singular spectacle of a creed which is believed in practice for one set of reasons, though in theory it can only be justified by another; and which, through some beneficent accident, turns out to be true, though its origin and each subsequent stage in its gradual development are the product of error and illusion."

Finally surveying the ruins of the captured fort, Mr. Balfour exclaims:

"Nothing in the history of speculation is more astonishing, nothing—if I am to speak my whole mind—is more absurd than the way in which Hume's philosophic progeny—a most distinguished race—have, in spite of all their differences, yet been able to agree, *both* that experience is essentially as Hume described it, *and* that from such an experience can be rationally extracted anything even in the remotest degree resembling the existing system of the natural sciences." (Pp. 96, 97.)

I have recalled to the reader's memory these strategic advances of a powerful and avowed enemy to Naturalism as a philosophy, partly with the object of showing that the position in which Huxley entrenched himself was regarded by one who had no narrow and petty cause to fight for, as a position of importance and worth capturing, and partly with a view to indicating that Mr. Balfour's logical projectiles have not pierced or weakened the central citadel of experience. For if there be any truth in the conclusions set forth in the preceding pages, Mr. Balfour has only succeeded in taking outposts which the captains of experience should never have occupied. If he have forced the soldiers of science to fall back upon more tenable ground, and compelled them to defend the co-ordinate reality of the objective and subjective in all their details, he will, in my judgment, have done them a signal service. The position of naturalism will be the stronger for his spirited attack.

By naturalism I here mean a system of knowledge founded on experience in its widest and most comprehensive sense. Within that system experience may be trusted implicitely as far as it goes —and no farther. Although it may occasionally lead to false inferences, it is not habitually inaccurate, still less mendacious. Only when dealing with problems outside its proper sphere does it talk nonsense. It is by no means a complete system of knowledge, but is full of gaps, and ends off in ragged edges. It does not afford an explanation of the universe. Nay, I am prepared to go further and assert that experience does not and cannot furnish a philosophical explanation of anything, its rôle being to describe the past and anticipate the future. It deals with sequences which, under the

appropriate conditions, it finds to be practically invariable. And if it commonly speaks of the causes of events, when it should be content with describing their antecedents, it is but borrowing, consciously or unconsciously, the language of metaphysics. Experience of past sequences enables us to predict the future in similar terms. There its guidance ceases. In presence of the problem of causation it is smitten with the dumbness of agnosticism.

And beyond the babble of experience all is silence! On what men of thought in all ages have regarded as the deepest problems of existence we are to ask no questions, or at any rate are to expect no answers! I, for one, am unable to assent to these propositions. I do indeed contend that the whole edifice of scientific knowledge is securely founded on the realities of experience. If, however, I be asked whether I am content to accept the universe as inexplicable, I have no hesitation in replying that I am not. Behind the sequential realities of experience I believe in a causal reality which makes that experience possible and explicable. But, as Mr. Rudyard Kipling would say, that is another story.

C. LLOYD MORGAN.

BRISTOL, ENGLAND.

ISOLATION IN ORGANIC EVOLUTION.

A POSTHUMOUS ESSAY BY THE LATE GEORGE JOHN ROMANES

THE PRESENT ARTICLE will be devoted to the consideration of what, in my opinion, is one of the most important principles that are concerned in the process of organic evolution—namely, Isolation. I say in *my* opinion such is the case, because, although the importance of isolation is more or less recognised by every naturalist, I know of only one other who has perceived all that the principle involves. This naturalist is the Rev. J. Gulick, and to his essays on the subject I attribute a higher value than to any other work in the field of Darwinian thought since the date of Darwin's death.[1] For it is now my matured conviction that a new point of departure has here been taken in the philosophy of Darwinism, and one which opens up new territories for scientific exploration of an endlessly wide and varied character. Indeed I believe, with Mr. Gulick, that in the principle of Isolation we have a principle so fundamental and so universal, that even the great principle of Natural Selection lies less deep, and pervades a region of smaller extent. Equalled only in its importance by the two basal principles of Heredity and Variation, this principle of Isolation constitutes the third pillar of a tripod on which is reared the whole superstructure of organic evolution.

By isolation I mean simply the prevention of intercrossing between a separated section of a species or kind and the rest of that

[1] It will be remembered that I regard Weismann's theory of heredity, with all its deductive consequences, as still *sub judice*.

species or kind. Whether such a separation be due to geographical barriers, to migration, or to any other state of matters leading to exclusive breeding within the separated group, I shall indifferently employ the term isolation for the purpose of designating what in all cases is the same result—namely, a prevention of intercrossing between A and B, where A is the separated portion and B the rest of the species or kind.

The importance of isolation as against dissimilar forms has always been fully appreciated by breeders, fanciers, horticulturists, etc., who are therefore most careful to prevent their pedigree productions from intercrossing with any other stock. Isolation is indeed, as Darwin has observed, "the corner-stone of the breeder's art." And similarly with plants and animals in a state of nature: unless intercrossing with allied (i. e., dissimilar) forms is prevented, the principle of heredity is bound to work for uniformity, by blending the dissimilar types in one: only when there is exclusive breeding of similarly modified forms can the principle of heredity work in the direction of change—i. e., of evolution.

Now, the forms of isolation—or the conditions which may lead to exclusive breeding—are manifold. One of the most important, as well as the most obvious, is geographical isolation; and no one questions that this has been an important factor in the process of evolution, although opinions still vary greatly as to the degree of its importance in this respect. At one end of the series we may place the opinion of Mr. Wallace, who denies that any of what may be termed the evolutionary effect of geographical isolation is due to "influence exerted by isolation *per se*." This effect, he says, is to be ascribed exclusively to the fact that a geographically isolated portion of a species must always encounter a change of environment, and therefore a new set of conditions necessitating a new set of adaptations at the hands of natural selection.[1] At the other end of the series we must place the opinion of Moritz Wagner, who many years ago published a masterly essay,[2] the object of which

[1] *Darwinism*, p. 150.

[2] *The Darwinian Theory, and the Law of Migration* (Eng. Trans., Stanford, London, 1873.)

was to prove that, in the absence of geographical isolation (including migration), natural selection would be powerless to effect any change of specific type. For, he argued, the initial variations on which the action of this principle depends would otherwise be inevitably swamped by free intercrossing. Wagner adduced a large number of interesting facts in support of this opinion; but although he thus succeeded in enforcing the truth that geographical isolation is an important aid to organic evolution, he failed to establish his conclusion that it is an indispensable condition. Nevertheless, he may have been right—and, as I shall presently show, I believe he was right—in his fundamental premiss, that in the presence of free intercrossing natural selection would be powerless to effect divergent evolution. Where he went wrong was in not perceiving that geographical isolation is not the only form of isolation. Had it occurred to him that there may be other forms quite as effectual for the prevention of free intercrossing, his essay could hardly have failed to mark an epoch in the history of Darwinism. But, on account of this oversight, he really weakened his main contention, namely, that in the presence of free intercrossing natural selection must be powerless to effect divergent evolution. This main contention I am now about to reargue. At present, therefore, we have only to observe that Wagner did it much more harm than good by neglecting to perceive that free intercrossing may be prevented in many other ways besides by migration, and by the intervention of geographical barriers.

In order that we may set out with clearer views upon this matter, I will make one or two preliminary remarks on the more general facts of isolation as these are found to occur in nature.

In the first place, it is obvious that isolation admits of degrees: it may be either total or partial; and, if partial, may occur in numberless grades of efficiency. This is so manifest that I need not wait to give illustrations. But now, in the second place, there is another general fact appertaining to isolation which is not so manifest, and a clear appreciation of which is so essential to any adequate consideration of the subject, that I believe the reason why evolutionists have hitherto failed to perceive the full importance of

isolation, is because they have failed to perceive the distinction which has now to be pointed out. The distinction is, that isolation may be either discriminate or indiscriminate. If it be discriminate, the isolation has reference to the resemblance of the separated individuals to one another; if it be indiscriminate, it has no such reference. For example, if a shepherd divides a flock of sheep without regard to their characters, he is isolating one section from the other indiscriminately; but if he places all the white sheep in one field, and all the black sheep in another field, he is isolating one section from the other discriminately. Or, if geological subsidence divides a species into two parts, the isolation will be indiscriminate; but if the separation be due to one of the sections developing, for example, a change of instinct determining migration to another area, or occupation of a different habitat on the same area, then the isolation will be discriminate, so far as the resemblance of instinct is concerned.

With the exception of Mr. Gulick, I cannot find that any other writer has hitherto stated this supremely important distinction between isolation as discriminate and indiscriminate. But he has fully as well as independently stated it, and shown in a masterly way its far-reaching consequences. Indiscriminate isolation he calls Separate Breeding, while discriminate isolation he calls Segregate Breeding. For the sake, however, of securing more descriptive terms, I will coin the words Apogamy and Homogamy. Apogamy, of course, answers to indiscriminate isolation, or separate breeding. Homogamy, on the other hand, answers to discriminate isolation, or segregate breeding: only individuals belonging to the same variety or kind are allowed to propagate. Isolation, then, is a genus, of which Apogamy and Homogamy are species.[1]

[1] I may here most conveniently define the senses in which all the following terms will be used throughout the present discussion;—*Species* of isolation are, as above stated, homogamy and apogamy, or isolation as discriminate and indiscriminate. *Forms* of isolation are modes of isolation, such as the geographical, the sexual, the instinctive, or any other of the numerous means whereby isolation of either species may be secured. *Cases* of isolation are the instances in which any of the forms of isolation may be at work: thus, if a group of n intergenerants be segregated into five groups, a, b, c, d, e, then, before the segregation there would

Now, in order to appreciate the unsurpassed importance of isolation as one of the three basal principles of organic evolution, let us begin by considering the discriminate species of it, or Homogamy.

To state the case in the most general terms, we may say that if the other two basal principles are given in heredity and variability, the whole theory of organic evolution becomes neither more nor less than a theory of homogamy,—that is, a theory of the causes which lead to discriminate isolation, or the breeding of like with like to the exclusion of unlike. For the more we believe in heredity and variability as basal principles of organic evolution, the stronger must become our persuasion that discriminate breeding leads to divergence of type, while indiscriminate breeding leads to uniformity. This, in fact, is securely based on what we know from the experience supplied by artificial selection, which consists in the intentional mating of like with like to the exclusion of unlike.

The point, then, which in the first instance must be firmly fastened in our minds is this: so long as there is free intercrossing, heredity cancels variability and makes in favor of fixity of type. Only when assisted by some form of discriminate isolation, which determines the exclusive breeding of like with like, can heredity make in favor of change of type, or lead to what we understand by organic evolution.

Now, the forms of discriminate isolation, or homogamy, are very numerous. When, for example, any section of a species adopts somewhat different habits of life, or occupies a somewhat different station in the economy of nature, homogamy arises within that section. There are forms of homogamy on which Darwin has laid great stress, as we shall presently find. Again, when for these or any other reasons a section of a species becomes in any small degree modified as to form or color, if the species happens to be one where any psychological preference in pairing can be exercised—as is very generally the case among the higher animals—exclusive breeding is apt to ensue as a result of such preference; for there is

have been one case of isolation, but after the segregation there would be five such cases.

abundant evidence to show that, both in birds and mammals, sexual selection is usually opposed to the intercrossing of dissimilar varieties. Once more, in the case of plants, intercrossing of dissimilar varieties may be prevented by any slight difference in their seasons of flowering, of topographical stations, or even, in the case of flowers which depend on insects for their fertilisation, by differences in the instincts and preferences of their visitors.

But, without at present going into detail with regard to these different forms of discriminate isolation, there are still two others, both of which are of much greater importance than any that I have hitherto named. Indeed, these two forms are of such immeasurable importance, that were it not for their virtually ubiquitous operation, the process of organic evolution could never have begun, nor, having begun, continued.

The first of these two forms is sexual incompatibility—either partial or absolute—between different taxonomic groups. If all hares and rabbits, for example, were as fertile with one another as they are within their own respective species, there can be no doubt that sooner or later, and on common areas the two types would fuse into one. And similarly, if the bar of sterility could be thrown down as between all the species of a genus, or all the genera of a family, *not otherwise prevented from intercrossing*, in time all such species, or all such genera, would become blended into a single type. As a matter of fact, complete fertility, both of first crosses and of their resulting hybrids, is rare, even as between species of the same genus; while as between genera of the same family complete fertility does not appear ever to occur; and, of course, the same applies to all the higher taxonomic divisions. On the other hand, some degree of infertility is not unusual as between different varieties of the same species; and, wherever this is the case, it must clearly aid the further differentiation of those varieties. It will be my endeavor to show that in this latter connexion sexual incompatibility must be held to have taken an immensely important part in the differentiation of varieties into species. But meanwhile we have only to observe that *wherever* such incompatibility is concerned it is to be regarded as an isolating agency of the very

first importance. And as it is of a character purely physiological, I have assigned to it the name Physiological Isolation; while for the particular case where this general principle is concerned in the origination of specific types, I have reserved the name Physiological Selection.

The other most important form of discriminate isolation to which I have alluded is Natural Selection. To some evolutionists it has seemed paradoxical thus to regard natural selection as a form of isolation; but a little thought will suffice to show that such is really the most accurate way of regarding it. For, as Mr. Gulick says, "Natural selection is the exclusive breeding of those better adapted to the environment: . . . . it is a process in which the fittest are prevented from crossing with the less fitted, by the exclusion of the less fitted." Therefore it is, strictly and accurately, a mode of isolation, where the isolation has reference to adaptation, and is secured in the most effectual of possible ways,—i. e., by the destruction of all individuals whose intercrossing would interfere with the isolation. Indeed, the very term "natural *selection*" shows that the principle is tacitly understood to be one of isolation, because this name was assigned to the principle by Darwin for the express purpose of marking the analogy that obtains between it and the intentional isolation which is practised by breeders, fanciers, and horticulturists. The only difference between "natural selection" and "artificial selection" consists in this—that under the former process the excluded individuals must necessarily perish, while under the latter they need not do so. But clearly this difference is accidental: it is in no way essential to the process considered as a process of discriminate isolation. For, as far as homogamous breeding is concerned, it can matter nothing whether the exclusion of the dissimilar individuals is effected by separation or by death.

Natural selection, then, is thus unquestionably a form of isolation of the discriminate kind; and therefore, notwithstanding its unique importance in certain respects, considered as a principle of organic evolution it is less fundamental—and also less extensive—than the principle of isolation in general. In other words, it is but

a part of a much larger whole. It is but a particular form of a general principle, which, as just shown, presents many other forms, not only of the discriminate, but likewise of the indiscriminate kind. Or, reverting to the terminology of logic, it is a sub-species of the species Homogamy, which in its turn is but a constituent part of the genus Isolation.

So much then for homogamy, or isolation of the discriminate order. Passing on now to apogamy, or isolation of the indiscriminate kind, we may well be disposed, at first sight, to conclude that this kind of isolation can count for nothing in the process of evolution. For if the fundamental importance of isolation in the production of organic forms be due to its segregation of like with like, does it not follow that any form of isolation which is indiscriminate must fail to supply the very condition on which all the forms of discriminate isolation depend for their efficacy in the causing of organic evolution? Or, to return to our concrete example, is it not self-evident that the farmer who separated his stock into two or more parts indiscriminately, would not effect any more change in his stock than if he had left them all to breed together?

Well, although at first sight this seems self-evident, it is in fact untrue. For, unless the individuals which are indiscriminately isolated happen to be a very large number, sooner or later their progeny will come to differ from that of the parent type, or unisolated portion of the previous stock. And, of course, as soon as this change of type begins, the isolation ceases to be indiscriminate: the previous apogamy has been converted into homogamy, with the usual result of causing a divergence of type. The reason why progeny of an indiscriminately isolated section of an originally uniform stock—e. g., of a species—will eventually deviate from the original type is, to quote Mr. Gulick, as follows[1]:—"No two portions of a species possess exactly the same average character, and, therefore, the initial differences are for ever reacting on the environment and on each other in such a way as to ensure increasing

[1] *Divergent Evolution through Cumulative Segregation* (*Zool. Journal, Linn. Soc.*, Vol. XX., pp. 189-274).

divergence as long as the individuals of the two groups are kept from intergenerating." Or, as I stated this principle in my essay on *Physiological Selection*, published but a short time before Mr. Gulick's invaluable contributions to these topics:

"As a matter of fact, we find that no one individual 'is like another all in all'; which is another way of saying that a specific type may be regarded as the average mean of all its individual variations, any considerable departure from this average being, however, checked by intercrossing. . . . Consequently, if from any cause a section of a species is prevented from intercrossing with the rest of its species, we might expect that new varieties should arise within that section, and that in time these varieties should pass into new species. And this is just what we do find."[1]

The name which I gave to this cause of specific change was Independent Variability, or variability in the absence of overwhelming intercrossing. But it now appears to me that this cause is really identical with that which was previously enunciated by Delbœuf. Again, in his important essay on *The Influence of Isolation*, Weismann concludes, on the basis of a large accumulation of facts, that the constancy of any given specific type "does not arise suddenly, but gradually, and is established by the promiscuous intercrossing of all individuals." From which, he says, it follows, that this constancy must cease so soon as the condition which maintains it ceases —i. e., so soon as intercrossing (Panmixia) between all individuals ceases, or so soon as a portion of a species is isolated from its parent stock. To this principle he assigns the name of Amixia. But Weismann's Amixia differs from my Independent Variability in several important particulars; and on this account I have designedly abstained from adopting his term. Here it is enough to remark that it answers to the generic term Isolation, without reference to the *kind* of isolation as discriminate or indiscriminate, homogamous or apogamous. On the other hand, my Independent

[1] The passage proceeds to show that in view of this consideration we have a strong additional reason for rejecting the *a priori* dogma that all specific characters must necessarily be useful characters. For it is evident that any divergence of specific character which is brought about in this way need not present any utilitarian significance—although, of course, natural selection will ensure that it shall never be deleterious.

Variability is merely a restatement of the so-called "Law of Delbœuf," which, in his own words, is as follows:

"One point, however, is definitely attained. It is that the proposition, which further back we designated paradoxical, is rigorously true. A constant cause of variation, however insignificant it may be, changes the uniformity [of type] little by little, and diversifies it *ad infinitum*. From the homogeneous, left to itself, only the homogeneous can proceed; but if there be a slight disturbance ['léger ferment'] in the homogeneous, the homogeneity will be invaded at a single point, differentiation will penetrate the whole, and, after a time—it may be an infinite time—the differentiation will have disintegrated it altogether."

In other words, the "Law," which Delbœuf has formulated on mathematical grounds, and with express reference to the question of segregate breeding, proves that, no matter how infinitesimally small the difference may be between the average qualities of an isolated section of a species compared with the average qualities of the rest of that species, if the isolation continues sufficiently long, differentiation of specific type is necessarily bound to ensue. But, to make this mathematical law biologically complete, it ought to be added that the time required for the change of type to supervene (supposing apogamy to be the only agent of change) will be governed by the range of individual variability which the species in question presents. A highly stable species (such as the Goose) might require an immensely long time for apogamy alone to produce any change of type in an isolated portion of the species, while a highly variable species (such as the Ruff) would rapidly change in any portion that might be indiscriminately isolated. It was in order to recognise this additional and very important factor that I chose the name Independent *Variability* whereby to designate the diversifying influence of merely indiscriminate isolation, or apogamy. Later on Mr. Gulick published his elaborate papers upon the divergence of type under all kinds of isolation; and retained my term Independent, but changed Variability into Generation. I point this out merely for the sake of remarking that his Independent Generation is exactly the same principle as my Independent Variability, and Delbœuf's Mathematical Law.

Now, while I fully agree with Mons. Giard where he says, in

the introductory lecture of his course on *The Factors of Evolution*,[1] that sufficient attention has not been hitherto given by naturalists to this important factor of organic evolution (apogamy), I think I have shown that among those naturalists who have considered it there is a sufficient amount of agreement. *Per contra*, I have to note the opinion of Mr. Wallace, who steadily maintains the impossibility of any cause other than natural selection (i. e., one of the forms of homogamy) having been concerned in the evolution of species. But at present it is enough to remark that even Professor Ray Lancaster—whose leanings of late years have been to the side of ultra-Darwinism, and who is therefore disposed to agree with Mr. Wallace wherever this is logically possible—even Professor Ray Lankaster observes:

"Mr. Wallace does not, in my judgment, give sufficient grounds for rejecting the proposition which he indicates as the main point of Mr. Gulick's valuable essay on *Divergent Evolution through Cumulative Segregation*. Mr. Gulick's idea is that . . . . no two portions of a species possess exactly the same average character. and the initial differences will, if the individuals of the two groups are kept from intercrossing, assert themselves continuously by heredity in such a way as to ensure an increasing divergence of the forms belonging to the groups, amounting to what is recognised as specific distinction. Mr. Gulick's idea is simply the recognition of a permanence or persistency in heredity, which, *caeteris paribus*, gives a twist or direction to the variations of the descendants of one individual as compared with the descendants of another."[2]

Now we have seen that "Mr. Gulick's idea," although independently conceived by him, had been several times propounded before; and it is partly implicated in more than one passage of the *Origin of Species*, where free intercrossing, or the *absence* of isolation, is alluded to as maintaining the *constancy* of a specific type.[3] Moreover, it is still more fully recognised in the last edition of the *Variation of Animals and Plants*, where a paragraph is added for the purpose of sanctioning the principle in the imperfect form that it was stated by Weismann.[4] Nevertheless, to Mr. Gulick belongs the credit, not only of having been the first to conceive (though

[1] *Revue Scientifique*, Nov. 23, 1889. [2] *Nature*, Oct. 10, 1889, p. 368.
[3] *E. g.*, p. 81. [4] See Chapter xxiii, vol. ii, p. 262. (Edition of 1888.)

the last to publish) the "idea" in question, and of having stated it with greater fulness than anybody else; but still more of having verified its importance as a factor of organic evolution.

For, in point of fact, Mr. Gulick was led to his recognition of the principle in question, not by any deductive reasoning from general principles, but by his own particular and detailed observations of the land mollusca of the Sandwich Islands. Here there are an immense number of varieties belonging to several genera; but every variety is restricted, not merely to the same island, but actually to the same valley. Moreover, on tracing this fauna from valley to valley, it is apparent that a slight variation in the occupants of valley 2 as compared with those of the adjacent valley 1, becomes more pronounced in the next—valley 3, still more so in 4, etc., etc. Thus it was possible, as Mr. Gulick says, roughly to estimate the amount of divergence between the occupants of any two given valleys by measuring the number of miles between them.

As already stated, I have myself examined his wonderful collection of shells, together with a topographical map of the district; and therefore I am in a position to testify to the great value of Mr. Gulick's work in this connexion, as in that of the utility question previously considered. The variations, which affect scores of species, and themselves eventually run into fully specific distinctions, are all more or less finely graduated as they pass from one isolated region to the next; and they have reference to changes of form and color, which in no one case presents any appearance of utility. Therefore—and especially in view of the fact that, as far as he could ascertain, the environment in the different valleys was essentially the same—no one who examines this collection can wonder that Mr. Gulick attributes the results which he has observed to the influence of apogamy alone, without any reference to utility or natural selection.

To this solid array of remarkable facts Mr. Wallace has nothing further to oppose than his customary appeal to the argument from ignorance, grounded on the usual assumption that no principle other than natural selection *can* be responsible for even the minutest changes of form or color. For my own part, I must confess

that I have never been so deeply impressed by the dominating influence of the *a priori* method as I was on reading Mr. Wallace's criticism of Mr. Gulick's paper, after having seen the material on which this paper is founded. To argue that every one of some twenty contiguous valleys in the area of the same small island must necessarily present such differences of environment that all the shells in each are differently modified thereby, while in no one out of the hundreds of cases of modification in minute respects of form and color can any human being suggest an adaptive reason therefor,—to argue thus is merely to affirm an intrinsically improbable dogma in the presence of a great and consistent array of opposing facts.

I have laid special stress on this particular case of the Sandwich Islands' mollusca, because the fifteen years of labor which Mr. Gulick has devoted to their exhaustive working out have yielded results more complete and suggestive than any which so far have been forthcoming with regard to the effects of isolation in divergent evolution. But, if space permitted, it would be easy to present abundance of additional facts from other sources, all bearing to the same conclusion,—namely, that as a matter of direct observation, no less than of general reasoning, any unprejudiced mind will concede to the principle of indiscriminate isolation an important share in the origination of organic types. For as indiscriminate isolation is thus seen sooner or later to become discriminate, and as we have already seen that discriminate isolation is a necessary condition to all or any modification, we can only conclude that isolation in both its kinds takes rank with heredity and variability as one of the three basal principles of organic evolution.

Having got thus far in the way of generalities, we must next observe sundry further matters of comparative detail.

1. In any case of indiscriminate isolation, or apogamy, the larger the bulk of the isolated section the more nearly must its average qualities resemble those of its parent stock; and, therefore, the less divergence of character will ensue in a given time from this cause alone. For instance, if one-fourth of a large species were to be separated from the other three-fourths (say, by sub-

sidence causing a discontinuity of area), it would continue the specific characters unchanged for an indefinitely long time, so far as the influence of such an indiscriminate isolation is concerned. But, on the other hand, if only half a dozen individuals were to be thus separated from the rest of their species, a comparatively short time would be needed for their descendants to undergo some varietal modification at the hands of apogamy. For, in this case, the chances would be infinitely against the average characters of the original half-dozen individuals exactly coinciding with those of all the rest of their species.

2. In any case of homogamy, however, it is immaterial what proportional number of individuals are isolated in the first instance. For the isolation is here discriminate, or effected by the initial difference of the average qualities themselves—a difference, therefore, which presupposes divergence as having already commenced, and equally bound to proceed whether the number of intergenerants be large or small.

It may here be remarked that, in his essay on the *Influence of Isolation*, Professor Weismann fails to distinguish between the two kinds of isolation. This essay deals only with one of the many different forms of isolation—the geographical—and is therefore throughout concerned with a consideration of diversity as arising from apogamy alone. But in dealing with this side of the matter Weismann anticipated both Gulick and myself in pointing out the law of inverse proportion, which I have stated in the preceding paragraph in what appears to me its strictly accurate form.

3. Segregate Breeding, or homogamy, which arises under any of the many forms of discriminate isolation, must always tend to be *cumulative*. For, again to quote Mr. Gulick, who has constituted this fact the most prominent as it is the most original feature of his essay, "In the first place, every new form of Segregation[1] that now appears depends on, and is superimposed upon, forms of Segregation that have been previously induced; for when Negative Segregation arises [i. e., isolation due to mutual sterility], and the va-

[1] This term may here be taken as equivalent to isolation.

rieties of a species become less and less fertile with one another, the complete infertility that has existed between them and some other species does not disappear, nor does the Positive Segregation cease [i. e., any other form of isolation previously existing]. . . . In the second place, whenever Segregation is directly produced by some quality of the organism, variations that possess the endowment in a superior degree will have a larger share in producing the segregated forms of the next generation, and accordingly the segregative endowment of the next generation will be greater than that of the present generation; and so with each successive generation the segregation will become increasingly complete." And to this it may be added, in the third place, that where the segregation (isolation) is due to the external conditions of life under which the organism is placed, or where it is due to natural selection simultaneously operating in divergent lines of evolution, the same remarks apply. Hence it follows that discriminate isolation is, in all its forms, cumulative.

4. The next point to be noted is, that the cumulative divergence of type thus induced can take place only in as many different lines as there are different *cases* of isolation. This is a point which Mr. Gulick has not expressly noticed; but it is one that ought to be clearly recognised. Seeing that isolation secures the breeding of similar forms by exclusion (immediate or eventual) of those which are dissimilar, and that only in as far as it does this can it be a factor in organic evolution, it follows that the resulting segregation, even though cumulative, can only lead to divergence of organic types in as many directions as there are cases of isolation. For any one group of intergenerants only *serial* transformation is possible, even though the transformation be cumulative through successive generations in the single line of change. But there is always a probability that during the course of such *serial transformation in time*, some other case of isolation may supervene, so as to divide the previously isolated group of intergenerants into two or more further isolated groups. Then, of course, opportunity will be furnished for *divergent transformation in space*—and this in as many different lines as there are now different homogamous groups.

That this must be so is further evident, if we reflect that the evolutionary power of isolation depends, not only on the *preventing* of intercrossing between the isolated portion of a species and the rest of that species, but also upon the *permitting* of intercrossing between all individuals of the isolated portion, whereby the peculiar average of qualities which they as a whole present may be allowed to assert itself in their progeny—or, if the isolation has been from the first discriminate, whereby the resulting homogamy may thus be allowed to assert itself. Hence any one case of either species of isolation, discriminate or indiscriminate, can only give rise to what Mr. Gulick has aptly called "monotypic evolution," or a chain-like series of types arising successively in time, as distinguished from what he has called "polytypic evolution," or an arborescent multiplication of types arising simultaneously in space.

For example, let us again take the geographical form of isolation. Where a single small intergenerant group of individuals is separated from the rest of its species—say, on an oceanic island—*monotypic* evolution may take place through a continuous and cumulative course of independent variation in a single line of change: all the *individuals* composing any one given generation will closely resemble one another, although the *type* may be progressively altering through a long series of generations. But if the original species had had two small colonies separated from itself (one on each of two different islands, so giving rise to two cases of isolation), then *polytypic* evolution would have ensued to the extent of there having been two different lines of evolution going on simultaneously (one upon each of the two islands concerned). Similarly, of course, if there had been three or four such colonies, there would have been three or four divergent lines of evolution, and so on.

5. In the *cases* of isolation just supposed there is only one *form* of isolation; and it is thus shown that under one form of isolation there may be as many lines of divergence as there are separate cases of such isolation. But now suppose that there are two or more forms of isolation—for instance, that on the same oceanic island the original colony has begun to segregate into secondary groups under the influence of natural selection, sexual selection,

physiological selection, or any of the other forms of isolation—then there will be as many lines of divergent evolution going on at the same time (and here on the same area) as there are forms of isolation affecting the oceanic colony. And this because each of the *forms* of isolation has given rise to a different *case* of isolation.

Now, inasmuch as different forms of isolation, when thus superadded one to another, constitute different cases of isolation, we may lay down the following general law as applying to all the forms of isolation,—namely, *The number of possible directions in which divergent evolution can occur, is never greater than, though it may be equal to, the number of cases of efficient isolation—or the number of efficiently separated groups of intergenerants.*

6. We have now to consider with some care the particular and highly important form of isolation that is presented by natural selection. For while this form of isolation resembles all the other forms of the discriminate kind in that it secures homogamy, there are two points in which it differs from all of them, and one point in which it differs from most of them.

Natural selection differs from *all* the other known forms of isolation (whether discriminate or indiscriminate) in that it has exclusive reference to *adaptations* on the one hand, and, on the other hand, necessitates not only the elimination, but the destruction of the excluded individuals. Again, natural selection differs from *most* of the other forms of isolation in that, unless assisted by some other form, it can never lead to polytypic, but only to monotypic evolution. The first two points of difference are here immaterial; but the last is one of the highest importance, as we shall immediately perceive.

In nearly all the other forms of isolation, polytypic or divergent evolution may arise under the influence of that form alone, or without the necessary co-operation of any other form. This we have already seen, for example, in regard to geographical isolation, under which there may be as many different lines of transmutation going on simultaneously as there are different cases of isolation,—say, in so many different oceanic islands. Again, in regard to physiological isolation the same remark obviously applies; for it is

evident that even upon the same geographical area there may be as many different lines of transmutation going on simultaneously as there are cases of this form of isolation. The bar of mutual sterility, whenever and wherever it occurs, must always render polytypic evolution possible. And so it is with almost all the other forms of isolation: that is to say, one *form* does not necessarily require the assistance of another *form* in order to create an additional *case* of isolation. But it is a peculiarity of natural selection, considered as a form of isolation, that it does necessarily require the assistance of some other form before it can give rise to an additional case of isolation; and therefore before it can give rise to any *divergence* of character in ramifying lines, as distinguished from *transformation* of characters in a single line. Or, in other words, natural selection, when acting alone, can never induce polytypic evolution, but only monotypic.

That this important conclusion is a necessary deduction from the theory of natural selection itself, a very few words will be enough to show. For, according to the theory, survival of the fittest is a form of isolation which acts through utility, by *destroying* all the individuals whom it fails to isolate. Hence it follows that survival of the fittest is a form of isolation which, if acting alone, cannot *possibly* effect divergent evolution. For, in the first place, there is nothing in this form of isolation to ensure that the fitter individuals should fail to interbreed with the less fit which are able to survive; and, in the second place, in all cases where the less fit are not sufficiently fit to be suffered to breed, they are exterminated —i. e., not permitted to form a distinct variety of their own. If it be said that survival of the fittest may develop simultaneously two or more lines of *useful* change, the answer is that it can only do this if each of the developing varieties is isolated from the others by some *additional form* of isolation; for, if not, there can be no commencement of utilitarian *divergence*, since whatever number of utilitarian changes may be in course of simultaneous development, they must in this case be all blended together in a single line of specific transmutation. Nay, even if specific divergence has actually been commenced by natural selection when associated with some other form

of homogamy, if the latter should afterwards be withdrawn, natural selection would then be unable to maintain even so much divergence of character as may already have been attained: free intercrossing between the two collateral, and no longer isolated branches, would ensure their eventual blending into a common stock. Therefore, I repeat, natural selection, when acting alone, can never induce polytypic evolution, but only monotypic.

Now I regret to say that here, for the first and only time throughout the whole course of my treatment of these subjects, I find myself in seeming opposition to the views of Darwin. For it was the decidedly expressed opinion of Darwin that natural selection *is* competent to effect polytypic, or divergent, evolution. Nevertheless, I believe that the opposition is to a large extent only apparent, or due merely to the fact that Darwin did not explicitly state certain considerations which throughout his discussion on "divergence of character" are seemingly implied. But, be this as it may, I have not even appeared to desert his leadership on a matter of such high importance without having duly considered the question in all its bearings, and to the utmost limit of my ability. Moreover, about two years after the publication of my first paper[1] upon the subject, Mr. Gulick followed, at somewhat greater length, in the same line of dissent. Like all the rest of his work, this is so severely logical in statement, as well as profoundly thought out in substance, that I do not see how it is possible for any one to read impartially what he has written, and then continue to hold that natural selection, if unassisted by any other form of isolation, can possibly effect divergence of character—or polytypic as distinguished from monotypic evolution.[2]

I may here quote from Mr. Gulick's paper three propositions, serving to state three large and general bodies of observable fact, which severally and collectively go to verify, with an overwhelming mass of evidence, the conclusion previously reached on grounds of general reasoning.

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[1] *Zool. Journal Lin. Soc.*, Vol. XIX. pp. 337–411.

[2] *Ibid.*, Vol. XX. pp. 202–211.

"The facts of geographical distribution seem to me to justify the following statements:

"1. A species exposed to different conditions in the different parts of the area over which it is distributed, is not represented by divergent forms when free interbreeding exists between the inhabitants of the different districts. In other words, Diversity of Natural Selection without Separation does not produce divergent evolution.

"2. We find many cases in which areas, corresponding in the character of the environment, but separated from each other by important barriers, are the homes of divergent forms of the same or allied species.

"3. In cases where the separation has been long continued, and the external conditions are the most diverse in points that involve diversity of adaptation, there we find the most decided divergences in the organic forms. That is, where Separation and Divergent Selection have long acted, the results are found to be the greatest.

"The 1st and 3rd of these propositions will probably be disputed by few, if by any. The proof of the 2nd is found wherever a set of closely allied organisms is so distributed over territory that each species and variety occupies its own narrow district, within which it is shut by barriers that restrain its distribution, while each species of the environing types is distributed over the whole territory. The distribution of terrestrial molluscs on the Sandwich Islands presents a great body of facts of this kind."

MAN AS A MEMBER OF SOCIETY.[1]

PART II.

UP TO THE PRESENT we have seen: (1) primitive man acquiring his first specific and distinctive characters; (2) the family at its origin among the savage tribes and the variations which it subsequently underwent; (3) the manner in which the first societies were constituted, and the principal forms which they afterwards assumed; (4) the two classes of evils with which they are affected, the one external in character—militarism—the other internal in its action—the antagonism of classes and individuals. Our purpose has been twofold: first, to describe human societies in their general characters as we described animal societies; and secondly, to show how the human species after issuing from the state of nature progressively attained the elevated social state in which we see it to-day; in other words, to follow its evolution, which was impossible in the case of animals. We have now to inquire what were the main and collateral influences that have been instrumental in retarding or accelerating the transformations of these societies and in bringing about their differentiations.

1. *The Influence of Races.*—If we look at the present distribution of the various groups of humanity which have been arrested at, or have retrograded to (a fact often difficult to establish), some given one of the stages which we have examined, the influence of the factor of race is incontestable. The black races of Africa and

[1] Translated from Dr. Topinard's MS. by T. J. McCormack. Part I. appeared in *The Monist* for July, 1897.

of Oceanica, physically the ugliest, yet the most authentic and least crossed of all, are the lowest in civilisation. Most of them are still in the primordial fetishistic period; none of them have given birth to social organisations at all extended; some black hordes have indeed in times past created military monarchies, but their creations were ephemeral and have passed away without leaving any noticeable traces. No ruins or megalithic monuments exist among them giving the least evidence of prior relatively civilised states; the few ruins found in Southwestern Africa are derived undoubtedly from the reddish blacks or crossed Arabs who may be regarded as affined to the primitive Egyptian race. The Australoid race of Huxley, of which we really know but one authentic group, the Australians, are in the same predicament. They have created no institutions, have left no memorials. The characteristic of all the black races is their inaptitude to rise by their own efforts.

Passing to the yellow races, carefully excluding here the retrograded groups, like the Esquimaux and the Fuegians, we find them divided into groups which in favorable circumstances are rarely so low in type as the Botocudos, which sometimes attain an average level, like the Polynesians and generally speaking the Indians of the two Americas and the Dravidians of India, but just as often reach a relatively high level, like the Aztecs of Montezuma, the builders of the temples of Yucatan, the Peruvians of Manco-Capac, and, nearer to us in point of time, the Malays, the Chinese, the Indo-Chinese, and the Japanese. The characteristic of the yellow races is a certain quickness in apprehending the means of satisfying the immediate needs of life and of rendering existence agreeable; but they have little initiative, do not know how to raise themselves to higher planes, and are prone to immobilisation.

The white races remain. These are nowhere discovered in the low stages. They have already a relatively high civilisation in Europe during the prehistoric epochs—namely, during the Reindeer, Palafitte, and Hallstattian periods. They have had their phase of barbarism, like the Franks and the Germans, but one which was

already quite advanced. In the Orient and in Africa, since the first glimmerings of history, their civilisations were astonishingly high, and they had already commenced cultivating the sciences and letters. If I may be permitted to advance a rather bold and perhaps premature opinion, I should reduce the white races to four. The first, brown, small, and dolichocephalic, embraces the Mediterranean races of which I have already spoken; consequently the Greeks and Romans, the Berbers and Egyptians; and further, all the modern and ancient Semites of philology. The second, also brown, but of relatively high stature, embraces the conquerors of the Vedic epoch in India, the Persians, and certain others at which I cannot stop. The third comprehends the brachycephalic Celto-Slavs, concerning the relationship of which to some ancient Asiatic group, of which the Galtchas[1] are at present the nearest known representatives, I reserve for the present my opinion. The fourth is the dolichocephalic race, blond and of high stature, at present predominating in the Northern parts of Europe. Now, if we except the brachycephalic group, which although numerous and prolific played in prehistoric Europe only a subordinate rôle[2], we find it is these white races that founded all the great political states and all the great civilisations of Europe prior and subsequent to the Christian era. The characteristics of the white races are their marked aptitude for developing by their own independent efforts and for assimilating the empirical results of others, their ever increasing need of comfort, their vigorous and comprehensive cere-

[1] P. Topinard. "On the Celts and Galtchas." In *Bull. Soc. of Anthr. of Paris.* 1878, pp. 117, 247, 383, 391; and 1879, p. 220, etc.

[2] My opinion that the Celto-Slavic race is one of the primitive branches of the yellow races, and made its appearance in the Neolithic epoch, explains the subordinate rôle which it then and subsequently played. Sedentary by habit, following the movements of the populations with which it was in contact, but without notable personal initiative, willing to emigrate but readily returning home again, adaptable to all occupations, industrious, economical, sober and having few needs, it reminds us of the Chinese. The fact that in Europe, situated between the brown and blond races, who are so given to progress, it has remained stationary, like the Chinese, is deserving of remark. Examples of this race are, the Savoyards and the Auvergnats which I know best.

bral activity, and their spirit of initiative, which the expression "go ahead" of one of them so aptly expresses.

It cannot, therefore, be doubted for an instant that race has had a considerable influence upon the development of human societies. All races, in our opinion, if favored by circumstances, may progress, particularly when they are in contact with stronger races. But they have not all the same aptitude, and many which we have never known and which even anatomical anthropology cannot disclose, must have utterly vanished. There is a chance here of writing an exceedingly interesting chapter on the psychological characters of races from this point of view—characters which are just as trustworthy for distinguishing between them as are physical characters.

2. *The Influence of Language.*—At the beginning of this century, when comparative philology arose, an epoch of infatuation set in, which reached its maximum when Balbi in 1826, in an effort to moderate its pretensions, published his *Introduction à l'atlas ethnographique du globe.* Up to 1869, or thereabouts, and despite the brilliant discussion which took place in the Anthropological Society of Paris, writers invariably confounded peoples with races and languages with races. These times are gone by. We are today in the right path. We know that languages perish, decline, and are superseded in part or in whole, that their boundaries advance or recede without reference to race, as circumstances and frequently diplomatists determine. Philologically there are Aryans, but there are no Aryans by race. There is a French race from the point of view of language, there is none from the point of view of anthropology. But if language has no relation to race, it has to peoples or nationalities. A common language strengthens the bonds between the different fractions of the same people, encouraging the exchange of ideas and the conduct of business. It assists in the mixture, crossing, and fusion of races, as does everything that tends to bring individuals closer together, and in lessening misunderstandings and causes of conflict, just as the same religion, similar customs, and like interests do. Such is the great influence that languages have exercised on social development. Two indi-

viduals who understand each other are nearer to agreeing and fraternising, whether they are of different blood or not. There are, it is true, federations of states, both large and small, maintained between groups differing in language and religion, but then there are mitigating circumstances and superior advantages involved which offset the resulting drawbacks. Moreover, these unions are often only superficially such; the integrant states form national sub-individualities, rivalry between which is always to be feared. In short, unity of language between remote or adjacent groups of men proves but one thing, that at some period they have lived together during a long interval of time. Nations are the products of the events of history and of politics.[1]

3. *The Influence of Population.*—I can touch only briefly upon this factor, although it is the most powerful of all evolution. I have already shown how by rendering existence more and more difficult the increase of population forced man to pass from the hunter and fisher stages to the pastoral and agricultural stages, and from the latter to the commercial and industrial stages. I further indicated how it led to the antagonism of classes and individuals. The increase of population, it is true, is a complex phenomenon. According to the celebrated theory of Malthus, propounded in 1798, in every hundred years the alimentary resources of a country increase in arithmetical proportion only, whilst the population increases in geometrical. But the facts have contradicted him, the resources have increased proportionately more, there has been overproduction and resulting surplus, whilst the rhythm of natality has diminished, because the enlightened and far-sighted classes voluntarily limit the number of their children. If to this cause, which in the present civilisation seems to be on the increase, there be added the lessened disposition to have children evinced by women struggling for emancipation, the question arises, What will this ultimately lead to?

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[1] P. Topinard, *Le principe des nationalités; Revue critique à propos de la péninsule des Balkans*, in *La Revue d'Anthropologie*, p. 124, 1886. The same, *La race en anthropologie*, in the *Comptes rendus du congrès internationa. d'anthropologie et de préhistorique de 1892 à Moscou.*

4. *Influence of Topographical, Climatic, and Alimentary Conditions.*—Although man is a cosmopolitan animal who adapts himself to all conditions, the influence of the factors here in question is indisputable, though it has rather the effect of differentiating than of accelerating or retarding social evolution. It should certainly not be overlooked. Just as individuals vary and are more or less favored in the aptitudes they exhibit, so the countries of the globe present conditions of existence which are widely different for man. One country is naturally defended, as an island, a peninsula, or high valley; it will be protected by a desert or a chain of mountains. Another, on the contrary, will be exposed to all incursions. One country will be rich in fauna and flora, in mines of coal and metals, in rivers and seaports. Another will be arid, sandy, rainless, and exposed to all the winds of heaven, or swampy and unhealthy, too hot or too cold.

Necessarily the stimulants to action will vary in all these different cases as to number, power, and quality, and will give rise to widely different impulses. Progress as a rule is proportionate to the difficulties encountered, providing the latter do not exceed a certain limit and do not bring in their train discouragement and resignation; in some circumstances reaction is impossible. The more a country is the object of rival desires, the more are the probabilities of its giving rise to advanced forms of society. Such are the valleys of the Nile, of the Tigris, and of the Euphrates, of the Yellow and Blue Rivers in China, of the Indus and the Ganges. Western Europe has always been a bone of contention with the so-called barbarous nations, and has given rise to the highest civilisations. Conversely, the least envied countries, like the deserts of Sahara and Kalahari, the steppes of Central Asia and Siberia, lofty plateaus between two chains of rocky mountains, are the habitats of peoples who have advanced only slowly in civilisation. Generally speaking, the northern peoples, who are subjected to an invigorating atmosphere, are more active than southern peoples, who are enervated by heat and inclined to indolence, and yet it is among the latter that the Chaldean, Persian, and Assyrian empires, Carthage, Greece, and Rome arose. Mountains afford a refuge for

quiet, sedentary, and industrious peoples, and fertile plains for pastoral nations, etc.

5. *The Influence of Adjacency.*—This factor is considerable, although the works never dwell upon it. A society cannot be the same if its neighboring society is warlike and turbulent, or peaceable and sedentary; or if it is enlightened, religious, devoted to the arts, and possessing good laws, or ignorant, sceptical, uncultivated, and badly governed. Emulation and example are factors of the first order. We look about us and acquire the manners, customs, faults, and excellences of our neighbors, just as we acquire their language, religion, their methods in science and philosophy, their fashions in literature, and their ideas of morality. The imitation which M. Tarde has emphasised is more frequently a psychical contagion than a voluntary act. It is operative outwardly among nations as well as within them between different strata of society. The enticement of fashion may be observed in all fields of human conduct. Habits, like ideas, are communicated. Chiefs, legislatures, professions yield to imitation as much as individuals.

6. *Influence of Circumstances.*—By this word, which Lamarck used to designate the sum-total of all the causes capable of exercising an influence upon existence and of producing changes therein, we understand here simply such determinative facts as occur unlooked for, which in the normal course would not have come to pass, and which are the origin of a new impulse imparted to a society that has become immobilised or is involved in a different course of evolution—an impulse which may give rise to both good and bad results. The circumstance may be violent or feeble in character, or even insignificant. Of the first class and in the physical order, we have an example in the eruption of the sea, say the Zuyderzee, over a vast surface occupied by a peaceful people, who are thus forced to become warlike and to go in quest of another habitable country, where their habits are necessarily completely altered. Another example of the same class is an invasion of barbarians, who, after putting everything to the fire and the sword, draw off, leaving behind them a people who in one case never recovering from their exhaustion will retrograde, or, in the other,

shaking off their lethargy, will rise again and enter upon a career of prosperity which otherwise they would never have pursued. As to feeble, inconspicuous circumstances, who has not, at some time or other, observed their puissant efficacy? Events most frequently are the resultant of an *ensemble* of dispositions and circumstances. Ten or twenty will be combined. One of them, perhaps the least effective, will play the part of the drop of water that causes a vessel to overflow and so will be the determining cause. If the drop of water had not come at the right moment, the other conditions would have been dissipated and the event delayed or deferred forever. Circumstances, whether potent or feeble, belong to the domain of chance so-called, and are a factor with which we must reckon in evolution and the directions which it takes.

7. *Influence of Individuals.*—This factor is for man what the preceding one is for things. Let us suppose that in the circumstances presumed above where everything has united to produce a certain effect, the right man is not present; either the effect will not be forthcoming, or it will miscarry. Conversely, suppose the situation is not yet ripe, but that some one of that class of men who are called geniuses and whose interposition people regard as providential, arises; then the event can occur and bring in its train decisive transformations. Truly, men amount to little when they are not the expression of their time, when they do not come at their psychological hour. Many, and some of the most brilliant even, have thus passed away without their fellow-creatures having derived the least advantage from their existence. Such are the majority of military heroes whom history places in the first rank, who fill the world with their reverberant personalities and leave nothing behind them but smoke. But by the side of these ill-timed geniuses whose efforts have been bootless, how many there are whom history or tradition mentions, and others whom the world has forgotten, that at some time, by some little thing, some new instrument, some new process, some law, or simply some example, merit being inscribed among the prime causes that determine evolution. This species of men, these shapers of progress, seem to be almost entirely wanting among the black races; they are scarce among the yellow

races; they are common among the white races. The stages of evolution may be represented by a net, the threaded pathways of which are variously tied together. At the points of crossing are bright, salient knots; the latter are the individuals that mark the changes of the pathways. Whilst in animals progress is effected by circumstances taken in the broad sense of Lamarck, in man it is principally effected by individuals. The *élite* individuals are the wealth of a nation.

8. *The Influence of Needs, as Infinitely Differentiated and Multiplied in All Directions.*—This is the last and most important, though an indirect, factor. Lamarck made it the second link of his chain which leads to adaptation. Outward circumstances, he said, engender needs, the latter new habits, the latter excess or deficiency of use of organs, which last causes adaptation.

The doctrine of Lamarck, which is diametrically opposed to that of Weismann, having regained to-day the position which rightly belongs to it, particularly in the United States, where it has been ably defended among others by the late Professor Cope, we shall give a *résumé* of the mechanism of the needs which play so prominent a part in it. Let us take the following example. An animal is placed in a new environment where in order to live it must breathe harder. The quantity of air being insufficient, a painful sensation is produced in the lungs, which reverberates throughout the entire organism. This is the need, that is to say, a solicitation at once local and general, to breathe more energetically. The animal responds to it by powerfully contracting its respiratory muscles, the lungs dilate more than before, more air enters, the circulation is accelerated, the organism experience the consciousness of well being, it is satisfied. The same solicitation is repeated, the same response is made, the animal acquires the habit of the act, the habit being repeated from generation to generation is transmitted and fixed and becomes an instinct, that is to say, a simple reflex action in which the will no longer intervenes. In consequence, the respiratory muscles have increased in volume, the fibres that best conform to the respiration demanded are hypertrophied while those which do not so lend themselves are atrophied. The

pulmonary tissue, now more active, has augmented, its areoles have multiplied, its vascular and nervous webs have become enriched. The adaptation of the new condition has been accomplished.

In this case the initial solicitation came from without. In other cases it comes from within; for example, when new kinds of food are introduced into the mouth or stomach. The masticatory muscles, the teeth, perhaps the jaws and salivary glands, and even the stomach itself are forced to adapt themselves to the new function which is imposed upon them. But the following is a more general case. By the very fact that an organ is doing work, the blood is conveyed to it in increased abundance, enhances its sum-total of life, and so it becomes of itself a stimulus to further work, and consequently to improved adaptation to the special kind of work in hand. Let the stimulus which has engendered the activity be continued, and the activity thus excited will by virtue of the momentum acquired go on increasing, perfecting, and differentiating itself, according to the character of the operation and to the parts which have been its principal seat.

Such, more than any other organ, is the brain. Highly vascular, and in richly endowed individuals eminently subject to stimulating impressions, it carries within it the principle of its own activity, its own improvement, and its own differentiation according to the character of the faculties which the individual sets in play, according to the impressions which he receives, the impressions which he accumulates, and the ideas which he elaborates. Few individuals are free to withdraw from its influence, or not to respond in the presence of excitations which have come from without or of incitations which have come from within. There are, it is true, races and groups of men who in all circumstances evince more or less *sang froid*, if I may be permitted the expression; individuals without resiliency and of apathetic temperament, acting only from habit and giving play to their general reflexes in which the will enters only from compulsion, as in walking and in certain spontaneous acts which are performed without reflexion. In such persons, cerebral action may become immobilised, may fall off, and

even retrograde. But at their side are those who possess in abundant measure that which is the characteristic of man, namely, a powerful cerebral activity, who are sensitive, lively, and militant. The latter are alert to impressions, direct their attention to wherever it is solicited, think, and never leave their brain at rest. In the latter, the potency of the cerebral organ increases, intellectual needs are multiplied and engender progress, both to the profit of the individuals themselves and to that of the society of which they are part.

This remarkable property of the brain, which in some measure is characteristic of all organs, of bearing within itself the stimulus to its own activity, is only a particular application of the broad and general biological law that every function, be it organic, sensory, or intellectual, tends to increase, if left to itself; or that action engenders action, sentiments sentiments, secretions secretions, hypergenesis hypergenesis, and, generally, that everything which has life has the need of living more, of living to the full. This is the sum and substance of that law of proliferation and of expansion which we cited as the first biological factor of evolution, on page 26 of *The Monist*, for 1895.

Needs in animals as in man are of two kinds: physical or organic, and psychic or intellectual; the latter attaining in man a development unknown in animals. Physical needs have reference to the conservation of the species or to the conservation of individuals. Breathing, eating, shelter from the elements, covering oneself with mud or dust as a protection against insects, running from the sheer love of exercising the muscles, are examples of these needs. Associating with one's fellows for amusement and mutual happiness, the desire to dominate, to protect, sometimes to sacrifice oneself for them, the wish to be approved of and admired, and the longing to excel in the chase or in racing, are examples of the psychical order.

Needs and their consequences embrace the same elements in man and in animals: solicitation to an act and the desire to respond to it, the pleasure experienced, of which the memory is preserved, which alone forms an inducement to repeat the act, and

satiety. In the animal, the surplus or deficiency of satisfaction obtained may bring about a differentiation of needs. The animal will feel, according to circumstances, the need of this or that kind of food, of this or that shelter, of this or that pleasure; he will be induced in various ways to satisfy his vanity and his need of society. In man, in whom the psychical element strengthens the organic need, and who discriminates between sensations and so arrives at the most varied distinctions, the physical needs are rapidly differentiated.

Thus, at the beginning man rent and devoured his prey raw. Chance attempts demonstrated to him that cooked flesh gave more satisfaction. He began over again, acquired a new habit, and thenceforth the use of cooked meat became a need, which assumed various forms and led later to the invention of the art of cooking. At the beginning he ate with his fingers and drank directly from the brook. One day he invented utensils and pottery. Eating and drinking from vessels became a necessity. Later a table was wanting, and a seat for making himself more comfortable at his repasts. Then he longed for decorated vessels and all sorts of superfluities, —all habits empirically aquired and ultimately becoming needs which he had to satisfy. So also at first he went about naked. He began by using leaves, then skins, and finally sumptuous garments. And so it is in all things.

But with the multiplicity of needs or of demands life became more complex and more difficult. It became necessary to work more and to seek other resources. Three hours a day were sufficient to satisfy the original needs of man; ten, it may be, are necessary at present. Hunting was followed by barter, the raising of cattle, agriculture, and industry. In those days one constructed one's own dwelling. It is now necessary to run to the carpenter, the glazier, and the locksmith. To the struggle for life has been added the struggle for appearance,—the desire of possessing a more beautiful residence, larger grounds, distinguished social position, and political power,—all desires which men cannot resist, which form the greatest stimulants to individual activity, and which

constitute the agents of progress. This leads us to psychical needs.

9. *Psychical Needs.*—It goes without saying that in the preceding instances the brain is not indifferent, although it plays only a secondary rôle, being prompted thereto by external excitations. In psychical needs the case is different; here the action of the brain is primitive; the point of departure, the work and pleasure involved, are inherent in the cerebral organ itself, and are independent of the acts which may fortuitously result therefrom. These needs are of two kinds: (1) *sensitive* or *emotional*, that is to say, connected with the sensibility proper of the brain, with that sixth interior sense which gives us cognisance of what is going forward in the cerebral organ and which constitutes the sensorium; and (2) intellectual, that is to say, connected with the internal work which is going on, with the exercise itself of the faculties. Examples of the first kind are the need of belief, of worship and prayer, the need of loving and of being loved, the need of approbation and of admiration, whence the need of engaging in combat and of gaining glory, of leaving behind oneself a name. But these last are already of a mixed character closely related to the needs of the preceding paragraph. Examples of the second kind are the needs of knowledge, research, discovery, explanation, the need of inventing, of creating, of imagining, of setting oneself an ideal. They are in general more highly developed according as the action of the brain is more predominant, be it in the evolutionary scale of the human groups themselves or in the scale of individual variations within the same group. Here we may seek with most reason the characteristics of what Isodore Geoffroy St. Hilaire has called the human kingdom, and the personal dominant note of each individual.

Nevertheless, we find the germs of these needs here and there in animals. The dog, for example, who, motionless and intent, lovingly regards his master and worships him as a divinity and, when that master slays him, dies with tears in his eyes, is obeying a psychical need and finds its sole recompense in himself. In the same way, the bird or mammal who soars or runs with his fellows

of the same sex, shares their existence, and abandons himself to the joy of the occasion, is moved by none other than a cerebral need which purely internal pleasure consecrates. The ass or the horse who makes himself the chief of a troop for tyrannising over or protecting those feebler than himself, has also no other motive than a cerebral need. The fighting cock matched in a pit against another whom he has no reason for combating, and where there is even no female at stake, is not moved by considerations of advantage; his nervous centres simply command him, he obeys, his reward is the glory he wins—a psychical sentiment. The monkey, finally, who turns a screw to and fro in order to find out how it enters a hole, or twists a key in a lock in order to open a door, is not concerned about the advantage which he may derive therefrom; to have succeeded in finding out what he wants is his whole joy.

We cannot stop at all the complex types which psychical needs exhibit in man. We shall abide by those which best lead to the object which we have set ourselves, *videlicet*, to the active types which on the one hand have created the sciences, and on the other the arts, letters and philosophy, and to the passive type which has engendered sociability.

Taking as our criterion the way people have of looking at the world there are two kinds of cerebral organisation. External objects at rest or in motion are made known to us by our senses, which furnish us with images comparable to instantaneous photographs. These are centralised by the sensorium and stored up in its library. They are the materials upon which the intellectual faculties then exert their activity and from which they draw generalisations and relations, that is to say, ideas of the first, second, third, fourth, or fifth order, some having resemblance to the original images proper, others being more and more remote from the latter and still others being veritable creations, often having no palpable bonds with the ideas from which they sprang. Now certain minds can never lose from sight the photographic images of resting or moving objects, which images are the equivalents of the things of nature; they never omit comparing them with one another, always take account of the additions and modifications which

their individual sensibility imparts to them, and appraise and judge their reciprocal relations as if they were spectators observing them from above. They are the objective type. Others, on the other hand, suffer themselves to be carried away by their sensibility, by the labor to which they subject these images, and by their imagination. They confound with the objective images the new images which they have conceived and the ideals which they have deduced from them; they replace them by intuitions; they even go so far as to say that these images are the appearances and that the conceptions are the sole realities. They are the subjective type. The first have given rise to the sciences, the second to the arts and letters, and to philosophy,—the two opposed poles of human thought.

10. *The Sciences.*—These are the outcome of the need of knowing and of explaining, restricted by certain requirements of method, of which the following are the principal: to consider things objectively only; to begin with simple things; to hold steadfastly to the aim of one's research without anticipating the solution of the problem; to proceed from the known to the unknown; to stop when the facts forsake us, and then take refuge in agnosticism; not to forget the precept *qui va piano va sano;* to begin the edifice at the base. The first thing is to observe the phenomenon or object in the rough; the first operation consists in comparing it with a sufficient number of other phenomena or analogous objects, and to establish their differences or resemblances. The first result is one or several relations obtained by induction. Classification, more and more general views, analysis and experiment as means of control, and statistics, are the more advanced procedures. The end is the knowledge of the real world.

For a long time man was an observer only. He was led by empiricism, and not by methodical reasoning, to the moulding and baking of his first earthenware, to the mingling of tin and copper to form bronze, to the employing of bows and arrows, boomerangs, levers, wedges, rollers, etc. The first science that rises above the horizon of our knowledge is astronomy, which already presupposed considerable mental development. The honor of having cultivated it belongs to the Chaldean and Egyptian priests, and perhaps also

to the Chinese. Although counting does not make an early appearance among savages, yet the science of numbers followed; being unquestionably derived from the preceding. Then medicine succeeded with Hippocrates, a good observer but a weak theorist, natural history with Aristotle, who, in his *History of Animals*, advanced this science to a high pitch, human anatomy with Erasistratus and Herophilus, and physics with Archimedes. The start had been made. But with Christianity and the invasion of the barbarians, abysmal night set in. Faith, which is not favorable to the search for truth, diverted men's minds in other directions. In the sixteenth century, the sun arose again. The sciences resumed their career, began a majestic development, and have now reached the lofty altitude of the nineteenth century, crowned by its Darwins, Pasteurs, and Edisons, the preludes of new conquests, of which the limits cannot be foreseen.

11. *Arts and Letters.*—The second kind of cerebral activity, which bears within itself its own stimulants and its own reward, has, in a far broader sense than the former, its roots in the animal world, where it is manifested by the distinguishing of certain sensations that have already attained a considerable degree of delicacy. The birds listen morning and evening to one another's songs, respond, and render genuine concerts. Serpents may be charmed by the flute, the horse is roused by the sound of the trumpet, all have heard of the dog who, whenever its mistress played on the piano, ran to her door and listened long and absorbedly. Monkeys strike the trees in rhythmical cadence with their sticks. It is certain that some animals are moved by a bright and joyous morning, by a glorious sunrise when nature is in holiday attire, and it is not impossible that these moods have given rise in man to the sense of the beautiful.

In man the artistic sense is a complex and composite formation, in which the following factors enter: (1) the pleasure afforded by the senses, especially by sight and hearing, which leaves behind it a distinct and lively impression; (2) a quite peculiar subtlety of certain aspects of the sixth or internal sense, rising to what has been denominated the æsthetic sense; (3) the faculty of invention

or creation, augmented in certain directions by a more or less lively imagination; (4) the need, frequently but not always expressed, of reproducing the works which one has conceived or the ideal which one seeks to approach, in music, painting, sculpture, speech, or writing.

As far back as our archæological knowledge permits us to go, and as deep down as we descend in the scale of existing savages, we discover some taste for artistic things. We have the drawings of the Troglodytes of the Vézère, of the Esquimaux and the Australians. We have seen with our own eyes a Bushman girl of fifteen or thereabouts drawing designs which were remarkably accurate. Songs and dances accompanied by music are a pleasure which the savages of all countries affect. When the Esquimaux have a quarrel to settle they challenge each other to a duel in which each struggles to outdo the other in song and poetry. The literary collections of the redskins are being daily enriched.

If we pass on from this point to the first civilisations of history or of proto-history, architecture, decorative art, and even literature appear in Assyria and Egypt at a stage of development which is remarkable. Towards the year 1000 B. C., at the dawn of Grecian civilisation, the poems of Hesiod and Homer appeared. And in the age of Pericles we have an architecture, a decorative art, and a sculptor Phidias, that have never yet been surpassed.

All this justifies us, without going further, in concluding that the various factors which give birth to arts and letters, attained in man a high development far earlier than those which gave rise to science.

12. *Philosophy.*—The third species of cerebral activity, that has sprung from the inherent need of this organ to labor and finds in itself the sole reward of its labor, is philosophy. Its place would be between the two preceding. Like the first, it answers to the need of knowing and explaining; like the second, it proceeds from subjective sensibility, from the faculty of inventing, of creating, of imagining, and views its conceptions as absolute realities. Let us follow its development. Animals, as we have seen, in the presence of phenomena which they do not understand, retire confounded.

Savage man does the same. But he at least hazards the attempt of an explanation by investing the objects or phenomena in question with life and sentiments similar to his own. Later, this same savage, discovering or believing to discover in himself a double being, the one corporeal and the other spiritual, transfers the new notions regarding himself to objects without himself, to stones, plants, animals, or stars. This is the second period—animism. Here the savage is simply superstitious. Of these objects, or of their doubles, the spirits, he makes fetishes. To worship the products of imagination is superstition. Religions, at first more or less elementary, with their founders and priests, do not appear until later.

For a long time the sorcerer, that is to say, a man less credulous than the rest, and adroit in the sense of knowing how to reap personal advantage from the beliefs of his fellows, stood alone in his clan. Sorcerer and medicine man at once, he distributed amulets, drove out spirits from the bodies of the deceased, and caused the rains to fall. Consulted in the councils and on the departure of expeditions, he added to his prophetic functions of foretelling events, the performance of sacrifices designed to conjure evil spirits. With the increase of population, the number of sorcerers increased. The different sorcerers were led to combine, to act in concert, to consolidate their interests, and to regulate their rights and beliefs, which were the foundations of their power. Thus the sacerdotal caste arose, at times recruiting itself from the outside and at times hereditary. More intelligent than the others, more disposed to reflect, the priests were naturally inclined to seek more satisfactory explanations for the phenomena of nature, to distinguish general causes from particular causes, to reduce the number of the spirits, to champion the most important of these, and even to symbolise many of them. The cult of heroes, of personages in the tribe who had rendered it valuable services, and of ancestors, was mingled with the preceding beliefs. Having to speak to simple people, for whom it was necessary to materialise things, they were obliged to recast their ideas and to expound them by the help of fables and myths, which soon essayed to explain in a tangible form the origin of things, the existing phenomena of nature, and

often to guide the conduct of men. These were the first attempts of philosophy, already as utilitarian as they were mystical.

Animism was for a long time nothing but crude naturalism, intentionally fostered perhaps in the popular classes. Following the method of survivals, we have found it existing everywhere more or less. It was general in India at the time of the Vedas, throughout all ancient Egypt, and in China before Confucius. It frequently competed with the family cult of ancestors which existed by its side. Gradually, however, the number of the spirits diminished; some which possessed more general significance displaced the others. Such were the genii of light and darkness, the genii of good and evil, who were opposed in combat; and also the genii of the heavens, the sea, Hades, war, and the harvest, known among the Greeks by the name of Jupiter, Neptune, Pluto, Mars, and Ceres. There were thus constituted hierarchies of divinities, Olympi of gods and demi-gods, the anthropomorphic adventures of which have been recounted and embellished by the poets. This was the phase of refined polytheism, naturalistic at its base, sometimes symbolical in its culminations, part for the people and part for the initiated.

Religions consecrated a multitude of usages and ceremonies from which the sacerdotal class lived and which greatly augmented its power; but they also exerted a strong political influence. At times they lodged the entire governmental power in the priests; it is known that the Egyptian monarchy began some five thousand years before our era by Menes having overthrown the sacerdotal domination in Egypt and subsequently having established himself at Memphis. Sometimes they founded a collateral monarchic or oligarchic power, and suffered the laws to be promulgated as ordinances or revelations of the Gods. At other times they amalgamated scattered tribes and made of them a nationality. Again, they led up to genuine moral codes such as those of Brahma and Buddha in India, and Confucius in China..

The philosophical idea and the utilitarian idea were associated in the last instance. In China, without ever a word of God or of the immortal soul, it was held that the law of heaven was perfec-

tion and the law of earth the perfectioning of self; that duty is an internal obligation to which every one should bow, the object of which is fraternity and the basis the family organisation, fostered by the worship of ancestors, of which we have already spoken.[1]

Subsequently to the Vedas in India the two ideas led to a naturalistic pantheism and to a system of morality which was derived therefrom as follows. The trinity at the summit of the edifice comprised three principles: The first, the creator, or Brahma; the second, the destroyer, or Siva; the third, the conserver, or Vishnu. The immortal souls passed, for a cycle of years more or less prolonged, from one body to another, higher or lower in the natural scale, according to the conduct of the individual. The end and the final recompense of those who have attained by their conduct the last stage of wisdom or of good is the extinction of all evil by submersion in the great All. When one of these Brahman preachers was asked what the Supreme God was, he replied, Of what use is it to cudgel one's brains about a thing one can never know. It remains to be known whether this doctrine led the Hindus to the conduct which yields the greatest amount of happiness.

The utilitarian idea appears to have dominated among the Phœnician and Canaanite peoples. It gave rise to the doctrine of a personal national god who had created man and the people whom he had chosen and whose destinies he directed. With them he had made a covenant. He exacted from them blind and exclusive worship and obedience to the laws which he promulgated. In return he protected them, reserving the right of terrestrial punishment. Pantheism and the immortality of the soul are, according to M. Fouillée, the general tendency of the Aryan peoples as monotheism without the immortality of the soul is the characteristic of the Occidental Semitic peoples. Both seek the sanction of moral conduct in a power beyond the individual, whilst the Chinese place it in the

[1] It may be that the official religion of China is the apparent religion only, and that family religion is the real motive power, that has the most influence upon conduct. This is a question that is still to be looked into. See, among others, J. I. Lanessan, *La Morale des philosophes Chinois. Extraits des livres classiques de la Chine et de l'Annam.—Bibl. Scientif. Contemp.* Paris, 1896.

individual himself. The Egyptians are related to the Hindus by their belief in metempsychosis or in the transmigration of souls from animal to animal, but they have set a limit to the transmigration. The cycle has been fixed at three thousand years. A posthumous judgment is then pronounced by forty-two judges over whom Osiris presides. This conception of a single judgment after death, if not of a second, when the cycle has run out, passed through these peoples to the polytheism of Greece and Rome.

In Greece it was among the philosophers or thinkers by profession and not among the priests, that the fetishistic idea and then the generalised animistic idea (subsequently simplified and sometimes symbolised) reached its highest and most spiritual form. It became here the idea of unity pervading the All, but of a unity which was ineffable and undemonstrable, which was conceived as universal and eternal, and for which the name of God was reserved. This is idealistic pantheism.

Greek philosophy is the most striking known expression of the cerebral need above mentioned, which impels man to exercise his intellectual faculties from the sheer pleasure of the exercise. It is the most astonishing proof of the progress accomplished by reason since its modest origin in primitive man. It is proof of the unlimited confidence which man subsequently placed in himself and of the immeasurable sweep which his faculty of imagination took. Without any other empirical basis than the common observations which every one makes, Greek philosophy rose audaciously to the loftiest and boldest conceptions, not conceptions crowning an intellectual edifice, but conceptions which dominate it in imaginary realms of space. Its fundamental idea was this: nature is admirably co-ordinated in all its parts, things are bound together by a necessary connexion and have both efficient and final causes. Through mathematics the only science then advanced, that with which all minds were infatuated, they conceived and demonstrated the harmony of forms. By reason man similarly conceives and comprehends the order which reigns in all things.

At the beginning, Greek philosophy sought the principle of the world in water, air, and fire, then in motion, atoms, numbers, at-

tractions, and repulsions, and finally, in a divine and universal unity.[1]

For Plato, the things which the senses show us are appearances only, shadows (the relative). The true light is that of reason, the only realities (the absolute) are what reason conceives. Individuals die, their sensations are extinguished with them. That which reason has revealed is the truth that persists and is eternal. Ideas take precedence over sensations. God is the highest idea, the last, the supreme idea, the quintessence of the correct, the good, and the beautiful. Next comes reason which has conceived him—intelligence. Finally comes the third general idea, the world, the universal soul from which all particular souls emanate. The nature of man is two-fold. One is the spiritual, that is, the immortal part, the soul; the other is the corporeal part. The first commands the second and should make every effort to approach nearer to the universal soul of which it is an emanation and consequently to God, the supreme idea, the sovereign good. The virtuous man, the sage, is he whose conduct conforms to these principles. He is a destiny to himself. As a sanction, Plato admits the posthumous judgment of the soul in the manner of the Egyptians and of Greek polytheism as also the cycle (*Republic*).

Aristotle belongs apart. He is at once scholar and philosopher, he observes nature. He is the founder of natural history, of anthropology, of political science, and of political economy. According to Graef he is also the founder of positive philosophy because he was the first to introduce positive facts into philosophy. In writing his *Politics* he is said to have gathered for the purpose one hundred and fifty different constitutions. In many points he is in accord with Plato, but not in all. For him the attributes of bodies cannot be separated from these bodies. Abstract general ideas are nothing but words and names. The universal good, the universal absolute, do not exist; the individual soul is not immortal for without memory all personal consciousness is impossible;

[1] Paul Janet. *Histoire de la Philosophie, les problèmes et les écoles.* Paris, 1894.

every thing, every plant, every animal has its end—amelioration in the sense of its relative welfare. The goal of man is self-perfection with a view to happiness. Nature herself impels him to this end. Virtue is the appropriation of acts to this end. There are three kinds of virtues: animal, moral, and intellectual. Moral virtues consist in preserving a just mean. They are habits which have sprung from the repetition of acts by education.[1]

But by the side of the theorist in these two philosophers we have also the practical man, who knows how to change his point of view and to place himself on a level with his times. By the side of the above-mentioned transcendental works we have plans for social organisation expounded by Plato in his *Republic* and his *Laws* and by Aristotle in his *Politics* and *Morals*. The ideas which here reign supreme are the omnipotence of the State, public utility, and the natural inequality of man. At this epoch in Athens the mass of the population, as we have said, were slaves. A large number were aliens who had taken up their domicile there; a small body only, 9/100, were citizens, distributed into higher classes (priests, magistrates, and warriors) and into certain lower classes. Now the views of Plato and Aristotle had reference only to the citizens of the higher classes. Aristotle in his *Politics* says that the true citizens are only those who are neither farmers nor tradesmen, nor handicraftsmen,[2] and that some people were born to command, others to obey. The following is the general rule of society for Plato: each person should strengthen himself in his prerogatives, his rank, his profession, and not mingle in affairs which do not concern him. In the warrior class he demanded community of women and children and *selection* by the magistrates of the best producers, as in the case of selection for cattle, so as to obtain as subjects the strongest and most beautiful, that is to say, those who would be most useful to the State.[3] The public welfare is the first social

[1] *The Nicomachean Ethics of Aristotle.* Transl. by Peters. London, 1895. *La morale à Nicomaque d'Aristote.* Trad. par L. Cassan. Paris, 1886.

[2] *Aristote. La Politique.* Trad. de Thurot. Lib. IV. Ch. VIII. Art. 3. Paris.

[3] *Platon. L'Etat ou le Republique.* Trad. de Bastien. Lib. V. Ch. II. Art. 1 et 2. Paris.

principle, the only one indeed; the independence of individuals is subordinate to it. For Plato, as for Aristotle, the education that makes men is one of the first functions of the State. Both sacrifice the individual to the family and also to property.

Other Greek philosophers also busied themselves with practical morals. Socrates, contends Boutroux, is the real founder of the science of morals. Prior to him the sophists had in all laws distinguished the elements derived from nature and those derived from custom. Socrates distinguished unwritten laws which were universally admitted and had been instituted by the gods, and written or human laws. Happiness, utility, and good were one. The interest of each one conforms to the public weal. Socrates defends woman and the slave.

For the Stoics morals is the art of living. We must contemn the physical needs which do not depend on us and esteem only the moral needs of which we are masters. Happiness is within us in the exercise of our faculties, and for what does not concern us, in indifference. For the Epicureans, to follow nature and to seek pleasures, preferentially those of the mind, is the best rule. The doctrine of the first, although tinged with pride is a beautiful one, but like that of the second, led its later disciples at Rome to the extinction of all individual energy and to the consecration of egoism.

In sum, the Greek philosophers founded the intuitive method, the yoke of which philosophy has never yet been able to throw off. They opened up, in various directions, some spiritualistic and others materialistic, the paths which we are still following. They were the first consciously to attack the problems of human conduct, both individual and social; and yet in the general run they were dialecticians, sophists, and intellectual gymnasts only. But such as they were, they founded free inquiry, disintegrated the national polytheistic beliefs, and prepared the way for the revolution which was on the verge of accomplishment.

Society, which soon was epitomised in the Roman world, was just attaining in fact one of those critical phases in the history of evolution where all the circumstances coincide that are calculated to bring on transformations and provoke new adaptations. The

evils which militarism had engendered had reached their acme, morals had been perverted to the last degree, scepticism was universal and the disorganisation was complete.

It was then that in an unknown corner of Judea on the banks of a lake the glad tidings burst forth of a coming regeneration, and a voice was heard pleading the cause of the feeble, the humble and the oppressed, and saying: "Love ye one another." The doctrine, at first local and inculcated by a small number of apostles, soon extended with St. Paul to the Gentiles, and thenceforward its progress was rapid. Philosophy was not indifferent to it. Plotinus of Alexandria, who has been named the Jewish Plato, and also the father of the fathers of the Church, desiring to reconcile the Greek philosophy with the new ideas, distinguished in God three things: the Father, the Mediating Word, and the Holy Ghost. A little later Philo, the chief of the Alexandrian school, conceived the same Trinity as follows: the Good, the Intelligence, the Soul, three degrees of the same God, one derived from the other and consequently unequal—the Trinity which Christianity adopted at the Council of Nice, but modified, despite the efforts of Arius, as follows: the Father, Creator *ex nihilo* by a bare act of his will, the Son, and the Holy Ghost, all three of equal degree and forming but one single God in three persons. The creation *ex nihilo* was a step backwards.

Christianity, in effect, instead of conquering the pagan world, was conquered by it, as Huxley has remarked. The fathers of the Church were overreached, the councils gave way before manifold influences, concessions were made to the barbarians, the primitive spirit swerved from its initial path. The Church, centralised in one of its patriarchs, became by degrees a terrestrial power having its needs, its ambitions, and its army of monks. It pretended to universal monarchy, had its political struggles, and ended in a despotic tyranny which lasted for ages until the schism of Luther—a breach made in behalf of the right to examine the holy Scriptures, and of which one of the ethnical effects was to separate the Northern blond races from the Southern, Celtic, and brown races.

During the Middle Ages science had disappeared from the

West. Philosophy, hemmed in between metaphysics and theology, became scholasticism, which sought to reconcile Plato, Plotinus, and Aristotle with the needs of orthodoxy, and split hairs over subtle essences and entities. In the first phase, faith and reason were confounded: "*credo ut intelligam*," said St. Anselm. In the second, reason was placed in the service of faith. In the third, the nominalists denied all harmony between the two. All this culminated in lassitude and scepticism. In was then that a concourse of circumstances occurred which, as fifteen centuries before, was to transform the Western world, although differently, and which inaugurated modern times, to-wit: the return to the West of the knowledge that had taken refuge among the Arabs, the discovery of printing, which spread everywhere trustworthy texts; the discovery of the new world which quadrupled the surface of the earth to be observed and studied; the awakening of science with Copernicus, Galileo, Kepler, Rondelet, Vesalius, Harvey,[1] and finally, the Reformation.

On the downfall of scholasticism, the first care of philosophy was not the renouncing of what had been its essence, the search for the absolute by intuition and reason, but the overhauling of its methods which it sought to render more precise. On the one hand, Descartes, the orthodox representative, defended the sovereignty of reason and the mathematical method by postulates, successive unbroken deductions, hypotheses, and intuition. On the other hand, Francis Bacon, who was inspired by Aristotle, contended that the book of nature was the true tome to be deciphered and commented upon; that "for the futile reasonings of dialectics, observation and experience were to be substituted; for deduction, which drew consequences, induction which established principles;" and that observation is particularly necessary for the facts which we inwardly observe in ourselves.

The subsequent divergencies were founded less in the varying intellectual and logical make-up of each philosopher and in their

[1] P. Topinard. *Eléments d'anthropologie générale.* Chap. I., Paris, 1885. Edit.: Vigot frères.

method of applying their faculties than in their individual ways of feeling and conceiving. Philosophy in effect is simply a struggle between these elements. One is materialistic or idealistic, rationalistic or empirical, sees one's ideal in liberty, altruism, necessity, or something absolute, according to one's temperament. We have given endowments, variable endowments,[1] partly congenital, and partly acquired by the first impressions and the first readings of youth.[2]

Nevertheless, the conquests of science began to make themselves felt. The field of philosophy was narrowed; there was now less insistence on God and more on the world, man, morals, and the conditions of social life. The overhanging metaphysical cloud is more or less heavy, it sometimes nears the earth, and at spots suffers the light to pass through. There are two streams: the one, continues Descartes, in France with Pascal, Bossuet, Fénélon, and Malebranche, in Germany with Spinoza and Leibnitz; the other, in England, represented by Bacon, Hobbes, and Locke.[3] It is strange, but philosophers who are diametrically opposed to each other, who have started from different points and have conducted their reasonings differently, arrive when the figurative obscurities of their language are removed, at similar results—results which the freethinkers of to-day would not disavow.

Take Spinoza. He is a pantheist and proclaims the unity of substance and of perfect infinite being. Man is endowed with two natures, two different modes of this substance, the one spiritual, the other corporeal, in perfect pre-established harmony. Free will does not exist *a priori*, for everything is derived from the essence of God with absolute necessity; nor *a posteriori*, because our feeling of freedom is reducible to that of ignorance of the causes which determine us. Nature has no end and strives towards no goal; it

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[1] M. Topinard says: "On a telle ou telle grâce, une grâce variable," etc.—*Tr.*

[2] Leibnitz narrates that when scarcely fifteen years old he was debating whether he should champion Aristotle or Democritus.

[3] Alfred Fouillée. *Histoire de la Philosophie.* Paris, 1893. The same, *Extraits des Philosophes.* Paris, 1897. We have borrowed much from these two works, although not sharing all the views of their author.

is what it is, because it cannot be otherwise. Good and evil are merely ways of thinking; the useful is what affords us pleasure; morals are merely the science of utility, the science of happiness. To comprehend utility is all of the moral law and that which brings us near to God.

Another example is that of Kant, who in Germany marks the end of the eighteenth century. For him, God, the immortal soul, and personal liberty are moral necessities which we must admit if duty is to be justified. "The starry heaven above us, the moral law within us, are the only two things that call forth my admiration and respect," he writes. The only thing absolutely and immediately certain is duty. There are two sorts of commandments or imperatives, the one conditional and proceeding mainly from necessity, the other categorical, which is duty itself. To believe in liberty, without which the "ought" is impossible, is the first of all duties. There are in us two egos; one absolute, eternal, and unrelated to space and time; and the other sensuous, connected with our individuality and subject to determinism. The first is free, the second is not. Nature, such as science knows it, does not appear ruled by the moral law, but by laws which apparently are quite different from it. Ethics implies three postulates: (1) the possibility of harmony between morality and happiness, or the sovereign good; (2) the immortality of the soul; (3) the assumption that the sovereign good is the supreme end to which the universe tends and which the universe will reach. In brief, Kant reversed "the old metaphysics which was called the science of being or ontology and which thought itself the science of the absolute (Fouillée)," but he put in its place another which I shall call utilitarian metaphysics.

The other movement, in England, is particularly interesting for us. With Bacon, at the dawn of the revolution in that country,[1] it entered again on the path which had been opened twenty centuries previously by Socrates and Aristotle.

The end which laws should strive for, says Bacon, is simply

[1] The Novum Organum appeared in 1620. Charles I. ascended the throne in 1625.

that of rendering the citizens of a state happy. Private Right exists by the side of public Right; the study and the practice of law should be freed from pure empiricism as well as from all metaphysics.

Hobbes continues this thought. In practice as in theory, he says, necessity is our sole rule. Our sentiments are egoism transformed. To seek pleasure and avoid pain is the law of nature. The state of nature is war, the strongest wins: *homo homini lupus.* To put an end to this state, man forms societies, he renounces his individual rights, absolute over all things, on condition that others do likewise. This exchange of renunciations is a contract, that is to say, a reciprocal obligation equally binding upon all. But here Hobbes reaches a singular conclusion. In order to assure the execution of this contract, he proposes to lodge its absolute enforcement in the hands of a monarch who has unreserved power to take to task any one who seeks to avoid the compact but who is himself obligated in no wise. The contract of Hobbes is an abdication. The sovereign which Hobbes had in mind in his own time and in his own country was his friend Charles II.

Locke, fifty years after, resumed these ideas. The state of nature is neither the law of the strongest nor the inequality of men. Societies are established by the consent of all, that is to say, by a contract for protecting the natural rights of each, for dispatching external business with other societies, and for administering justice within. Man is permitted to alienate only that part of his rights and liberty which is strictly necessary for the maintenance of the association. He particularly reserves to himself that personal liberty which is the first of his rights, and his right to property acquired by work. The essential thing that he abandons is the right of personally administering justice. In constituting a legislative power and an executive power, he maintains his sovereignty and preserves his right to revolution if the contract is violated. Locke desired the separation of Church and State and tolerance for all religions.

Bacon, Hobbes, and Locke are the inaugurators of the English school, a school which is characterised by its practical spirit,

its observation and analysis of psychological facts, and by its disposition to refer the conduct of man to the advantages which he draws therefrom. It led to Adam Smith, who discovers the sanction of morality in altruism or public approbation; to Bentham, who sees it in interest rationally understood; to Hume and the Scottish school; and, finally, to the existing school of John Stuart Mill, Darwin, and Herbert Spencer.

Locke, on the other hand, is also the starting point of the French school of the eighteenth century, which is characterised by a tendency at once anti-clerical, altruistic, and sentimental. We have here Voltaire, Condillac, and the Encyclopædists; Helvétius, for whom "the whole art of legislation is to make it more advantageous for the individual to follow the law than to break it"; Montesquieu, who defined laws as "the necessary relations which are derived from the nature of things"; Rousseau and Condorcet. The Geneva philosopher best expresses that great love of humanity and that great need of individual liberty which was paramount at the dawn of the French Revolution. For him, the social problem was formulated thus: to find a form of association which protected and fostered with the whole power of the community the person and goods of each associated individual and by which each, though uniting with all, obeyed himself only and remained as free as before. Man in the state of nature was essentially gentle; he has been perverted by civilisation. Rousseau accepts the theory of a social contract as did Languet in 1577 and afterwards Hobbes, Locke, and Spinoza, but admits with Locke that certain natural rights, such as individual liberty, are inalienable.

We shall say nothing of the philosophy of the nineteenth century, of the German school which represents speculative philosophy, and of the English school which is physiological in bent, and of which we have the highest opinion. In France, the most notable achievement is the attempt which was made by August Comte.

For Comte metaphysics must be entirely eliminated. The day of intuitions, *a priori* conceptions, entities, innate ideas, is past. If a problem cannot be resolved, it is to be let alone. Psychology is

only a branch of physiology and the latter a division of biology. Morals rest not upon any imperative obligation but upon the altruism which education develops. There are no rights besides those which society confers. Human knowledge has passed through three stages: one of faith or theology, one of conceptions or metaphysics, and one of observation or science.

These, in sum, are the basal principles of science, and would be perfect if the positivist school were faithful to them. But in its own bosom even, there are refractory spirits who suffer themselves unconsciously to be ruled by their sentiments, rather than by observation, and who are constantly lapsing back into the old methods. For example, why should thinkers postulate a social organism similar to the animal organism, which is born, dies, etc.; or a mystical evolution which marches on inexorably towards a given end? Why have they systems of postulates and successive deductions, afterwards seeking the facts which agree with their preconceived opinions? Why have they characterisations or classifications of the sciences founded not on the objects observed but on the synthesis of the observations? The reason of it is that the majority of those whom positivism attracts are men of letters who have not been properly prepared for the search for the truth by practical preliminary studies in the physical and natural sciences. For me, there is but one method of knowing what is and of inducing therefrom what has been and what will be; all suggestions which transgress this method are void.

From this rapid examination of the evolution of philosophy we draw by way of *résumé* the following conclusions:

a. Philosophy, like religion, is the outcome of the belief in the supernatural held by man in his more or less primitive state.

b. The philosophic spirit and the spirit which created the arts and letters have as common characters their subjectivity, their need of imagining and of constructing, and their firm belief in the reality of their conceptions. Between the philosophical spirit and the mathematical spirit there is a further relation. We have mentioned the influence which mathematics exerted on the development of Greek philosophy and that influence persisted after the

Renaissance. Pythagoras and Leibnitz, to cite only two names, were as much mathematicians as philosophers. The first discovered the theorem of the square on the hypothenuse; the second invented the differential calculus. Descartes applied algebra to geometry. The connecting link between the two kinds of mind is the constant preoccupation with the logical order of things and the employment of the deductive method. On the other hand, between mathematicians and symphonic musicians we have also often observed a relation. Like these musicians, the mathematicians and philosophers are harmonists.

c. Philosophy is opposed to science. It answers to the impatient need of man to explain at once things which elude his comprehension.

d. Philosophy, when we clearly see its first expansion, is almost immediately at its culminating point, very likely because it was not yet bothered by science. Gradually it recognised that outside the facts there is nothing solid, but for a long time it could not tear itself from its illusions. At the present day it still lives, but is losing its initial character and sees itself obliged more and more to reckon with science and practice.

e. If with this waning evolution we compare that of the sciences, modest at the outset, slowly and laboriously advancing, but always with a sure and constant tread, and attaining to-day a height which is dazzling but which our grandchildren will regard as low in the extreme,—if we make this contrast, I say, we shall be obliged to say that the group of human faculties which has given birth to philosophy has a less prolonged future than that group which has given rise to science.

f. Philosophy, although on the wane, and apparently in disaccord with the end of the nineteenth century, has nevertheless a beautiful domain to exploit. Taking from it everything that belongs to the domain of facts and to the province of the *a posteriori*, there yet remains for it an important rôle upon which we shall touch later.

13. *The Altruistic Need.*—It remains to speak of the cerebral need which played an essential part in the formation of societies

and which enters into the principles that rule or should rule the societies which are derived therefrom.

Let us recapitulate what we have seen in animals. The first associations not induced by sexual instincts which occur between individuals or groups of individuals, were the result of indifferent circumstances. The habit came, then the pleasure, and finally an instinctive impulse to seek the company again. This may happen in animals of the same species or of different species which have no reason to fear each other, particularly among birds and herbivora. Collisions sometimes take place, but the pleasure of living together outweighs their drawbacks, and mutual concessions are made; the reciprocal need of altruism and of solidarity gains the upper hand. In short, the social instinct is quite remarkable and quite thoroughly consolidated in a large number of animals.

Man, who has sprung from social animals, has inherited this instinct or established need. In a state of nature, when the difficulties of life are simply of a refractory character, when there is room for all, where one has to struggle only with beasts and with nature, man's need of companionship as in the case of Robinson Crusoe before the advent of his man Friday, is the more imperious according as he has a highly developed faculty of exchanging ideas, a faculty which the animals lack, and according as these ideas are multiplied. In this stage, moreover, man has not yet learned to suppress himself. He is entirely spontaneous, he has not yet had experience of the necessity of looking beyond his acts.

At first his family almost entirely suffices to satisfy his need of company and the attendant needs of which we have already spoken. He is a good father, a good husband, and easy in manner, if we except certain savage and reflex habits. Later, when life is still not difficult, and when he lives in little bands, his conduct still remains natural. He yields to his first impulses, he does not analyse them, he has comrades whose company he enjoys in hunting and chatting, neighbors whom he treats as he wishes to be treated; he renders services without asking for anything in exchange; he spontaneously makes sacrifices for others as they do for him. In all things he behaves with frankness and does not know what it is to

lie. He is truly the child of nature. If he is struck he reacts, if he is offended he avenges himself. But without some reason and without being provoked to it, he never commits an injury but often does good. If he is a youth and makes a girl a mother he marries her. If one of the members of his family or one of his friends is attacked he springs to their defence, he identifies their cause with his own. Later, when the families become a clan, and the number of men likely to be found together has increased still more, a change sets in. The altruistic need or the desire for company finding wider scope, is displaced and extended far beyond the limits of the family. The individual prefers the pleasures of his companions to the joys of his own hearthstone; between him and them intercourse of friendship is established; a bond unconsciously unites them. If one is attacked by the members of another community, all rise in his defence.

In these different stages acts having appreciably the same motives are appreciably the same in all circumstances; the response to the same solicitation cannot vary much. All the members of a group or clan accustom themselves to regarding their empirical conduct as the best that can be followed. These acts being repeated become customs, of which all, that is to say public opinion, approve. To conform to that opinion is to act in the best manner. Not to conform to it is to oppose it, and, consequently, to deprive oneself of the approbation of that opinion to which one is sensitive.

The elders, the councils of these tribes, make these customs, which are consecrated by opinion, the basis of their judgments when called upon to settle differences. Tradition becomes the rule, and this receives the sanction of punishments. To obey the rule is good, to disobey it is bad. But if the elders assume the right to judge and punish, and if wrong-doers submit to their decisions, the reason is that the first take it for granted that the individual arraigned before them is responsible for his acts, and that the second are confident that they will be treated on a footing of equality before that tribunal.

In the state of nature man is restricted in his acts only by his

individual will, with or without thought as to their consequences. If he thinks he can kill an animal without being killed or wounded himself, he does so. If he thinks he is running too great a risk, he abstains from the deed. Towards his fellow-being he is not less free to act as he pleases, but more motives go to influence his conduct. One person is congenial to him, another is useful to him, renders him services, amuses him, loves him. Another is indifferent to him; but who knows whether on the morrow their rôles will not be changed, whether that other will then not be of use to him? Will the other not then behave as he himself has behaved? What will his family, what will public opinion say? People will censure him, will avoid him. The savage thus knows what he can and ought to do, and what restrictions he should impose upon his first impulses. The word rights, supposing he has any vague notion of anything of the kind, he would be incapable of understanding. He acts according to the circumstances; his conduct is restricted as regards his game; it is more so when in contact with one of his fellow-beings; it is still more so when in contact with several, and more so again when there are very many, as in societies.

It is the same with his obligations. By the very fact that the savage knows how to modify his conduct according to the circumstances and will consider that such and such acts must not be done, or that he must respect the personality of others, so that they in turn will respect his, that he makes concessions, etc., it is evident that the obligations which he assumes, are made by way of exchange. The whole matter is one of reciprocity. There is no understanding nor contract. Duty is but a word which we apply wrongly to animals; the one comprehends it no more than the other.

In short, among men more or less near the state of nature, acts are produced spontaneously as among animals; they are the best in the conditions given; they are not due to reasoning. The instinct to adapt acts to necessity is the whole thing. The ideas of good and of evil, of responsibility, justice, solidarity, rights and duties, liberty, have no effect upon conduct; they do not exist. The savage, abandoned to himself and untaught, acts empirically,

and his conduct is as correct as ours if not more so. His ethical notions conform to what his daily relations with his fellows demand; his acts are ruder, cruder, and more reflexive, but that is all.

It would be curious to know to what degree his internal sensibility enters into his acts, to what degree man yields to the blind impulse which leads him to long for the society of his fellows, what degree of pleasure he experiences in the sympathy he has for others, or that others have for him; whether he possesses in a developed degree the faculty of representing to himself the pleasure and pain of others, of feeling and sharing them; in a word, to what extent he is altruistic, whether in the first passive degree, which is benevolence, or in the second degree, which is charity (division of H. Spencer and others).

We have pointed out the qualities which savages generally exhibit in the state of nature. When we carefully read not memoirs but the long accounts of travellers and of missionaries who have lived in intimacy with them and have gained their confidence, there is no room for doubt. They are affectionate and devoted. It will be objected that their manners are brutal and that public opinion consecrates with them acts which we severely condemn. But are we ourselves so perfect, and are our manners, though refined, much superior? Witness what has just occurred in Armenia and what the courts daily reveal to us. Among certain savages, for example, public opinion approves of the man who has the courage to strangle a friend in agony in order to spare him useless suffering. Among others, sons abandon without food, or bury alive, their old and infirm fathers, who are incapable of following the nomadic band. But among these same savages, these same old men are listened to and respected, the sons know that their turn, too, will come, and they shed tears when in the last extremity they resolve upon their death. Moreover, facts of this character are rare, and are recounted by travellers because of their extraordinary nature. Savages surely do not understand morals as we do, but they have their morality nevertheless, and one which though different from ours has yet its value. They are straightforword, frank, loyal, and

not wicked. In altruism they are at the same stage as the average run of birds and of herbivorous mammals, and certainly at a degree higher than the generality of civilised races. The impulse which originally moved man to pass from the state of nature or purely family state to the social state was not interest but the need of being happy in the company of others, the need of exchanging ideas and sentiments.

We say originally, for as soon as the contact between men increased, as soon as the conditions of existence became difficult, the character of the scene changed and darkened. The struggle for existence, at first feeble, then gradually increasing in intensity, spreads and grows general among societies, classes, and individuals. To live in new conditions, every day more difficult, where fate has placed one, is ultimately the fortune of every one. Individualism augments, and conversely altruism diminishes. Men are constantly on their guard, weighing their acts. Experience renders them egoistic. To succeed, to rise, to dominate, to become rich, are the ruling passions. The more intelligent a man is, the less in general is his compassion, the more deaf he is to the cries of victims. Here and there a few altruists come to the surface, but they are the dupes. We recall again the saying of Hobbes: *homo homini lupus.*

True, this situation is not entirely due to civilisation. Nature is for the most part, if not entirely, responsible for it. It has made men signally unequal—some crippled, sick, and incapable of the least intellectual effort, others strong, healthy, and intelligent; some envious, hateful, wicked, and truculent, others gentle, loving, and devoted; some predestined from birth to premature death or a long life of suffering; others predestined to success and happiness. Animals have muscles, claws, and teeth, and use them when they are hungry. Man has but one weapon, but more poignant, venomous, and deadly—his intelligence—and he uses it even when he is not hungry to satisfy other needs multiplied a hundred fold by that intelligence. Animals of the same species rarely fight; men rend and devour each other.

Very early, long before Darwin, away back in the dim past, these facts had struck the attention of thoughtful men. In the

councils even of tribes not far advanced, when regulating punishments for deeds considered evil, the effort was made to forestall, soften, and correct them in the interests of the general weal. But as the particular interest of a sect or a monarch gained the upper hand, these efforts decreased; the cause of the feeble, the unfortunate, and the enslaved had none but secret defenders among *élite* men who were more sensitive to their suffering than those about them. At times these defenders were unknown legislators, as in Egypt where we find a few humanitarian laws inspired by lofty ideas of equality; at times they were members of the sacerdotal class who sought to offer consolation to the victims of nature and civilisation, to give them the hopes of posthumous compensation, as in India where the preachers of Buddha said: "Life is but a chain of evils, resign yourselves, conduct yourselves well, your recompense is Nirvâna."

Greek philosophy occupied itself little with the miseries of the classes who were really miserable. Its glance was directed higher; it imagined an ideal of happiness for the sages, an organisation useful for the state, and abided by these propositions. The words "justice," "good," and "evil" bristle in their discussion but in a different sense from that which we give to them nowadays and with reference to the order of nature, of which they see the excellences and not the faults. Aristotle distinguished justice of exchange and justice of distribution, but without insisting upon those unwritten laws which Socrates said were inscribed in the human heart. The Stoics and the Epicureans, as we have said, achieved nothing but the consecration of egoism. Some few legislators of antiquity, like Solon and Numa, appear to have been inspired a little with the moral idea as contrasted with the utilitarian idea which was everywhere predominant.

It was really not until the rise of Christianity that we see the establishment and spread of generous and altruistic ideas having in view not a single class of citizens but the pariahs of society who are so much in need of support and without distinction of class or nationality but bearing upon humanity at large. These were the ideas of love in its universal sense, of fraternity, equality, compas-

sion, charity, and disinterestedness; the distinction of moral good and evil, of private and public conduct, the notion of one's duty towards oneself and towards others. Nevertheless the progress was only superficial. Although legislators strove to inspire themselves with the new principles, their acts did not correspond to them. The masses of the population suffered as much as ever. The struggle was just as implacable, altruism was as sparsely sown as ever.

But after the Renaissance, the ideas which we briefly recapitulated in our review of the history of philosophy, steadily gained headway. The latent principles which should govern the organisation of society were discussed. The notion hitherto so vague, of rights, of individual liberty, unrestricted or curtailed by the social state, gradually assumed shape and solidity. The sentiments of reciprocal duty, solidarity, and responsibility were extended, the double declaration of the natural rights of man in 1776 in the United States and in 1790 in France, opened up a new era—the era of natural rights, that is of those which society cannot abrogate and which involve the correlative duty of respect for those rights in others.

This brings us to the present time at which more than ever the following questions dominate the whole of practical sociology.

On the one hand scientific facts show that nature in placing man at the acme of creation, and in having given him his intellect as his weapon of existence, has at the same time and in the same degree as the other animals, condemned him to an incessant struggle for the satisfaction of his needs, which are even multiplied by that intelligence. At the start that struggle was with individuals of other species, as it is among animals. At present it is carried on in the bosom of the species of itself between man and man, congenitally unequal and not responsible for that inequality. It engenders suffering, misery, and ruin, and divides humanity into oppressors and oppressed, conquerors and conquered.

On the other hand, all that is good in the human heart, love, compassion, generosity, regard for human dignity as a higher animal species, is aroused and protests energetically against this state

of things. It demands that fraternity shall not be an empty word written on the front of our edifices, that justice and peace shall reign, that each shall be recompensed for his efforts, and have his legitimate share in the general happiness, that solidarity shall be a reality.

On the one side egotism is arrayed, the principal factor in the struggle; on the other altruism, the principal factor of concord.

On the one side is the individual, always more or less an animal, knowing only his present life and desiring it to be the best possible. On the other is society, an impersonal and permanent being in which are resumed the experience of the past, the hopes of the future, and the happiness of the present, distributed equitably for the best, among all.

Is the reconciliation of these opposed factors possible? Are we to conclude, as we did in 1893, that science and practice are contradictory, that we cannot guide ourselves in rigorous conformity to truth? Must we admit social dogmas?

What lesson does our knowledge of social evolution up to the present day convey? In which phase of it are we now involved? Which new adaptations are the best? Towards what point on the horizon is our bark turned? Towards what shores will the wind waft us?

This is the subject which we shall examine in our last article which will bear the title "The Social Problem."

P. Topinard.

Paris.

ON SENSATIONS OF ORIENTATION.[1]

THROUGH the co-operation of a succession of inquirers, among whom are particularly to be mentioned Goltz of Strassburg and Breuer of Vienna, considerable advances have been made during the last twenty-five years in our knowledge of the means by which we ascertain our position in space and the direction of our motion; or orient ourselves, as the phrase goes. I presume that you are already acquainted with the physiological part of the processes with which our sensations of movement, or, more generally speaking, our sensations of orientation, are connected. Here I shall consider more particularly the physical side of the matter. In fact, I was originally led to the consideration of these questions by the observation of extremely simple and perfectly well-known physical facts, before I had any great acquaintance with physiology and while pursuing unbiasedly my natural thoughts; and I am of the conviction that the way which I have pursued, and which is entirely free from hypotheses, will, if you will follow my exposition, be that of easiest acquisition for the most of you.

No man of sound common sense could ever have doubted that a pressure or force is requisite to set a body in motion in a given direction and that a contrary pressure is required to stop suddenly a body in motion. Though the law of inertia was first formulated with anything like exactness by Galileo, the facts at the basis of it were known long previously to men of the stamp of Leonardo da

[1] A lecture delivered on February 24, 1897, before the *Verein zur Verbreitung naturwissenschaftlicher Kenntnisse in Wien*. Translated by T. J. McCormack.

Vinci, Rabelais, and others, and were illustrated by them with appropriate experiments. Leonardo knew that by a swift stroke with a ruler one can knock out from a vertical column of checkers a single checker without overthrowing the column. The experiment with a coin resting on a piece of pasteboard covering a goblet, which falls into the goblet when the pasteboard is jerked away, like all experiments of the kind, is certainly very old.

With Galileo the experience in question assumes greater clearness and force. In the famous dialogue on the Copernican system which cost him his freedom, he explains the tides in an infelicitous, though in principle correct manner, by the analogue of a platter of water swung to and fro. In opposition to the Aristotelians of his time, who believed the descent of a heavy body could be accelerated by the superposition of another heavy body, he asserted that a body could never be accelerated by one lying upon it unless the first in some way impeded the superposed body in its descent. To seek to press a falling body by means of another placed upon it, is as senseless as trying to prod a man with a lance when the man is speeding away from one with the same velocity as the lance. Even this little excursion into physics can explain much to us. You know the peculiar sensation which one has in falling, as when one jumps from a high springboard into the water, and which is also experienced in some measure at the beginning of the descent of elevators and swings. The reciprocal gravitational pressure of the different parts of our body, which is [illegible] felt in some manner, vanishes in free descent, or, in the case of the elevator, is diminished on the beginning of the descent. A similar sensation would be experienced if we were suddenly transported to the moon where the acceleration of gravity is much less than upon the earth. I was led to these considerations [illegible] by a suggestion in physics, and having also taken into account the alterations of the blood-pressure in the cases in question, I found I coincided without knowing it with Wollaston and Purkinje. The first as early as 1810 in his Croonian lecture had touched on the subject of sea-sickness and explained it by alterations of the blood-

pressure, and later had laid similar considerations at the basis of his explanation of vertigo (1820–1826).[1]

Newton was the first to enunciate with perfect generality that a body can change the velocity and direction of its motion only by the action of a force, or the action of a second body. A corollary of this law which was first expressly deduced by Euler is that a body can never be set *rotating* or made to cease rotating of itself but only by forces and other bodies. For example, turn an open watch which has run down, freely backwards and forwards in your hand. The balance-wheel will not fully catch the rapid rotations, it does not even respond fully to the elastic force of the spring which proves too weak to carry the wheel entirely with it.

Let us consider now that whether we move ourselves by means of our legs, or whether we are moved by a vehicle or a boat, at first only a part of our body is directly moved and the rest of it is afterwards set in motion by the first part. We see that pressures, pulls, and tensions are always produced between the parts of the body in this action, which pressures, pulls, and tensions give rise to sensations by which forward or rotary movements in which we are engaged are made perceptible. But it is quite natural that sensations so familiar should be little noticed and that attention should be drawn to them only under special circumstances when they occur unexpectedly or with unusual strength.

Thus my attention was drawn to this point by the sensation of falling and subsequently by another singular occurrence. I was rounding a sharp railway curve once when I suddenly saw all the trees, houses, and factory chimneys along the track swerve from the vertical and assume a strikingly inclined position. What had hitherto appeared to me perfectly natural, namely, the fact that we distinguish the vertical so perfectly and sharply from every other direction, now struck me as enigmatical. Why is it that the same direction can now appear vertical to me and now

[1] Wollaston, *Philosophical Transactions, Royal Society*, 1810. In the same place Wollaston also describes and explains the creaking of the muscles. My attention was recently called to this work by Dr. W. Pascheles.—Cf. also Purkinje, *Prager medicin. Jahrbücher*, Bd. 6, Wien, 1820.

cannot? By what is the vertical distinguished for us? (Compare Figure 1.)

The rails are raised on the convex or outward side of the track in order to insure the stability of the carriage as against the action of the centrifugal force, the whole being so arranged that the combination of the force of gravity with the centrifugal force of the train shall give rise to a force perpendicular to the plane of the rails.

Let us assume, now, that under all circumstances we somehow sense the direction of the total resultant mass-acceleration whencesoever it may arise as the vertical. Then both the ordinary and the extraordinary phenomena will be alike rendered intelligible.

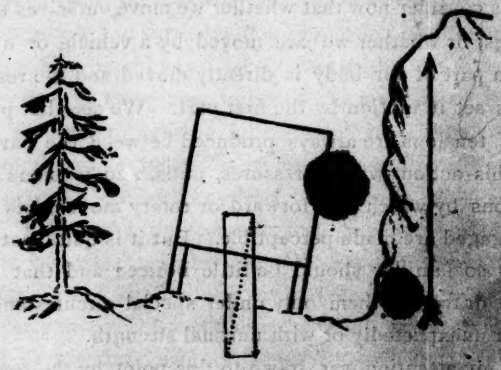

Fig. 1.

I was now desirous of putting the view I had [illegible] more convenient and exact test than was possible [illegible] journey where one has no control over the [illegible] stances and cannot alter them at will. I accordingly [illegible] ple apparatus constructed which is represented in [illegible]

In a large frame BB, which is fastened to the [illegible] about a vertical axis AA a second frame RR [illegible] a third one rr, which can be set at any [illegible] the axis, made stationary or movable, and [illegible] for the observer.

The observer takes his seat in the chair [illegible]

turbances of judgment is enclosed in a paper box. If the observer together with the frame *r r* be then set in uniform rotation, he will feel and see the beginning of the rotation both as to direction and amount very distinctly although every outward visible or tangible point of reference is wanting. If the motion be uniformly continued the sensation of rotation will gradually cease entirely and the observer will imagine himself at rest. But if *r r* be placed outside the axis of rotation, at once on the rotation beginning, a strikingly apparent, palpable, actually visible inclination of the entire paper box is produced, slight when the rotation is slow, strong when the rotation is rapid, and continuing as long as the rotation lasts. It is

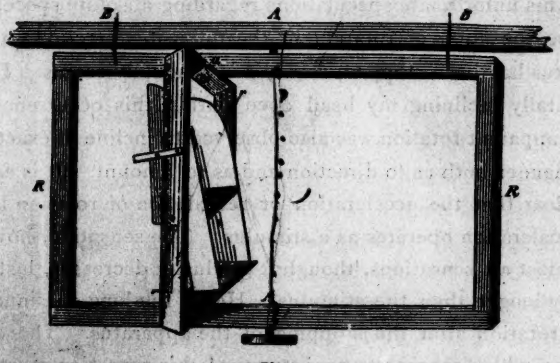

Fig. 2.
From Mach's *Bewegungsempfindungen*, Leipsic, Engelmann, 1875.

absolutely impossible for the observer to escape perceiving the inclination, although here also all outward points of reference are wanting. If the observer, for example, is seated so as to look towards the axis, he will feel the box strongly tipped backwards, as it necessarily must be if the direction of the total resultant force is perceived as the vertical. For other positions of the observer the situation is similar.[1]

Once, while performing one of these experiments, and after

[1] It will be observed that my way of thinking and experimenting here is related to that which led Knight to the discovery and investigation of the geotropism of plants. *Philosophical Transactions*, January 9, 1806. The relations between animals and animal geotropism have been more recently investigated by J. Loeb.

rotating so long that I was no longer conscious of the movement, I suddenly caused the apparatus to be stopped, whereupon I immediately felt and saw myself with the whole box rapidly flung round in rotation in the opposite direction, although I knew that the whole apparatus was at rest and every outward point of reference for the perception of motion was wanting. Every one who disbelieves in sensations of movement should be made acquainted with these phenomena. Had Newton known them and had he ever observed how we may actually imagine ourselves turned and displaced in space without the assistance of stationary bodies as points of reference, he would certainly have been confirmed more than ever in his unfortunate speculations regarding absolute space.

The sensation of rotation in the opposite direction after the apparatus has been stopped, slowly and gradually ceases. But on accidentally inclining my head once during this occurrence, the axis of apparent rotation was also observed to incline in exactly the same manner both as to direction and as to amount. It is accordingly clear that the acceleration or retardation of rotation is felt. The acceleration operates as a stimulus. The sensation, however, like almost all sensations, though it gradually decreases, lasts perceptibly longer than the stimulus. Hence the long continuance of apparent rotation after the stopping of the apparatus. [illegible] however, which causes the persistence of this sensation, has its seat in the *head*, since otherwise the axis of apparent rotation could not assume the same motion as the head.

If I were to say, now, that a light had flashed [illegible] making these last observations, the expression would be [illegible] one. I ought to say, I experienced a perfect flash. [illegible] juvenile experiences of vertigo occurred to me. [illegible] Flourens's experiments relative to the section of the semi-circular canals of the labyrinths of doves and rabbits, [illegible] had observed phenomena similar to vertigo, but [illegible] to interpret, from his bias to the acoustic theory, [illegible] as the expression of painful auditive disturbance. [illegible] Goltz had nearly but not quite hit the truth, [illegible] the semi-circular canals. This inquirer, who, [illegible]

of following his own natural thoughts without regard for tradition, has cleared up so much in science, spoke, as early as 1870, on the ground of experiments, as follows: "It is uncertain whether the semi-circular canals are auditive organs or not. In any event they form an apparatus which serves for the preservation of equilibrium. They are, so to speak, the sense-organs of equilibrium of the head and indirectly of the whole body." I remembered the galvanic dizziness which had been observed by Ritter and Purkinje on the passage of a current through the head, when the persons experimented upon imagined they were falling towards the cathode. The experiment was immediately repeated, and sometime later (1874) I was enabled to demonstrate the same objectively with fishes, all of which placed themselves sidewise and in the same direction in the field of the current as if at command.[1] Müller's doctrine of specific energies now appeared to me to bring all these new and old observations into a simple, connected unity.

Let us picture to ourselves the labyrinth of the ear with its three semi-circular canals lying in three mutually perpendicular planes (Cf. Fig. 3, p. 86), the mysterious position of which inquirers have endeavored to explain in every possible and impossible way. Let us conceive the nerves of the ampullæ, or the dilated extensions of the semi-circular canals, equipped with a capacity for responding to every imaginable stimulus with a sensation of rotation just as the nerves of the retina of the eye when excited by pressures, by electrical or chemical stimuli always respond with the sensation of light; let us picture to ourselves, further, that the usual excitation of the ampullæ nerves is produced by the inertia of the contents of the semi-circular canals, which contents on suitable rotations in the plane of the semi-circular canal are left behind in the motion, or at least have a tendency to remain behind and consequently exert a pressure. It will be seen that on this supposition all the single facts which without the theory appear as so many

[1] This experiment is doubtless related to the galvanotropic experiment with the larvæ of frogs described ten years later by L. Hermann. Compare on this point my remarks in the *Anzeiger der Wiener Akademie*, 1886, No. 21. Recent experiments in galvanotropism are due to J. Loeb.

different individual phenomena, become from this single point of view clear and intelligible.

I had the satisfaction, immediately after the communication in which I set forth this idea,[1] of seeing a paper by Breuer appear[2] in which this author had arrived by entirely different methods at results that agreed in all essential points with my own. A few weeks later appeared the researches of Crum Brown of Edinburgh, whose methods were even still nearer mine. Breuer's paper was far richer in physiological respects than mine, and he had particularly gone into greater detail in his investigation of the collateral effects of

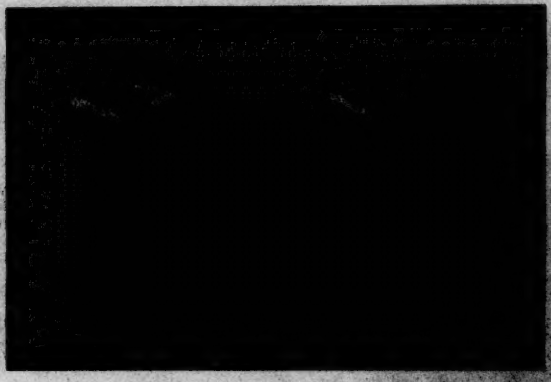

Fig. 3.
The labyrinth of a dove (stereoscopically reproduced), from R. Ewald, *Nervus Octavus*, Wiesbaden, Bergmann, 1892.

the reflex motions and orientation of the eyes in [illegible] under consideration.[3] In addition certain experiments suggested in my paper as a test of the correctness of the [illegible] in question had already been performed by Breuer. He also rendered services of the highest order in the [illegible] tion of this field. But in a physical regard, my [illegible] course, more complete.

[1] *Wiener Akad.*, 6 November, 1873.

[2] *Wiener Gesellschaft der Aerzte*, 14 November, 1874.

[3] I have made a contribution to this last question in my [illegible] *sations* (1886), English translation, 1897.

In order to portray to the eye the behavior of the semi-circular canals, I have constructed here a little apparatus. (See Fig. 4.) The large rotatable disc represents the osseous semi-circular canal, which is continuous with the bones of the head; the small disc, which is free to rotate on the axis of the first, represents the mobile and partly liquid contents of the semi-circular canal. On rotating the large disc, the small disc as you see remains behind. I have to turn some time before the small disc is carried along with the large one by friction. But if I now stop the large disc, the small disc as you see continues to rotate.

Fig. 4.
Model representing the action of the semi-circular canals.

Simply assume now that the rotation of the small disc, say in the direction of the hands of a watch, would give rise to a sensation of rotation in the opposite direction, and conversely, and you already understand a good portion of the facts above set forth. The explanation still holds, even if the small disc does not perform appreciable rotations but is checked by a contrivance similar to an elastic spring, the tension of which disengages a sensation. Conceive, now, three such contrivances with their mutually perpendicular planes of rotation joined together so as to form a single apparatus; then to this apparatus as a whole, no rotation can be imparted without its being indicated by the small mobile discs or by the springs which are attached to them. Conceive both the right and the left ear equipped with such an apparatus, and you will find that it answers all the purposes of the semi-circular canals, which you see represented stereoscopically in Fig. 3 for the ear of a dove.

Of the many experiments which I have made on my own person, and the results of which could be predicted by the new view

according to the behavior of the model and consequently according to the rules of mechanics, I shall cite but one. I fasten a horizontal board in the frame *RR* of my rotatory apparatus, lie down upon the same with my right ear upon the board, and cause the apparatus to be uniformly rotated. As soon as I no longer perceive the rotation, I turn around upon my left ear and immediately the sensation of rotation again starts up with marked vividness. The experiment can be repeated as often as one wishes. A slight turn of the head even is sufficient for reviving the sensation of rotation which in the perfectly quiescent state at once disappears altogether.

We will imitate the experiment on the model. I turn the large disc until finally the small disc is carried along with it. If, now, while the rotation continues uniform, I burn off a little thread which you see here, the small disc will be flipped round by a spring into its own plane 180°, so as now to present its opposite side to you, when the rotation at once begins in the opposite direction.

We have consequently a very simple means for determining whether one is actually the subject or not of uniform and imperceptible rotations. If the earth rotated much more rapidly than it really does, or if our semi-circular canals were much more sensitive, a Nansen sleeping at the North Pole would be waked by the sensation of rotation every time he turned over. Foucault's pendulum experiment as a demonstration of the earth's rotation [illegible] superfluous under such circumstances. The only [illegible] prove the rotation of the earth with the help of [illegible] the small angular velocity of the earth and in [illegible] bility to great experimental errors.[1]

Aristotle has said that "The sweetest of [illegible] edge." And he is right. But if you were to [illegible] *lication* of a new view were productive of [illegible] you would be mightily mistaken. No one [illegible] with a new view unpunished. Nor should the [illegible]

[1] In my *Grundlinien der Lehre von den Bewegungsempfindungen*, [illegible] matter occupying lines 4 to 13 of page 20 from below, which must [illegible] as I have also elsewhere remarked, to be stricken out. For [illegible] lated to that of Foucault, compare my *Mechanics*, p. 503.

ject of reproach to these fellow-men. To presume to revolutionise the current way of thinking with regard to any question, is no pleasant task, and above all not an easy one. They who have advanced new views know best what serious difficulties stand in their way. With honest and praiseworthy zeal, men set to work in search of everything that does not suit with them. They seek to discover whether they cannot explain the facts better or as well, or approximately as well, by the traditional views. And that, too, is justified. But at times some extremely artless animadversions are heard that almost nonplus us. "If a sixth sense existed it could not fail to have been discovered thousands of years ago." Indeed! There was a time, then, when only seven planets could have existed! But I do not believe that any one will lay any weight on the philological question whether the set of phenomena which we have been considering should be called a sense. The phenomena will not disappear when the name disappears. It was further said to me that animals exist which have no labyrinth, but which can yet orientate themselves, and that consequently the labyrinth has nothing to do with orientation. We do not walk forsooth with our legs, because snakes propel themselves without them! — Good.

But if the promulgator of a new idea cannot hope for any great pleasure from its publication, yet the critical process which his views undergo is extremely helpful to the subject-matter of them. All the defects which necessarily adhere to the new view are gradually discovered and eliminated. Over-rating and exaggeration give way to more sober estimates. And so it came about that it was found inadmissible to attribute all functions of orientation exclusively to the labyrinth. In these critical labors Delage, Aubert, Breuer, Ewald, and others have rendered distinguished services. It can also not fail to happen that fresh facts become known in this process which could have been predicted by the new view, which actually were predicted in part, and which consequently furnish a support for the new view. Breuer and Ewald succeeded in electrically and mechanically exciting the labyrinth, and even single parts of the labyrinth, and thus in producing the movements that belong to each stimuli. It was shown that when the semi-circular

canals were absent vertigo could not be produced, when the entire labyrinth was removed the orientation of the head was no longer possible, that without the labyrinth galvanic vertigo could not be induced. I myself constructed as early as 1875 an apparatus for observing animals in rotation, which was subsequently reinvented in various forms and has since received the name of "cyclostat."[1] In experiments with the most varied kinds of animals it was shown that, for example, the larvæ of frogs are not subject to vertigo until their semi-circular canals which at the start are wanting are developed (K. Schäfer).

A large percentage of the deaf and dumb are afflicted with grave affections of the labyrinth. The American psychologist, William James, has made whirling experiments with many deaf and dumb subjects, and in a large number of them found that susceptibility to giddiness is wanting. He also found that many deaf and dumb people on being ducked under water, whereby they lose their weight and consequently have no longer the full assistance of their muscular sense, utterly lose their sense of position in space, do not know which is up and which is down, and are thrown into the greatest consternation,—results which do not occur in [illegible]. Such facts are convincing proof that we do not [illegible] entirely by means of the labyrinth, important as it [illegible]. Kreidl has made experiments similar to those of James [illegible] that not only is vertigo absent in deaf and dumb [illegible] whirled about, but that also the reflex movements [illegible] are normally induced by the labyrinth are wanting [illegible]. Pollak has found that galvanic vertigo does not [illegible] percentage of the deaf and dumb. Neither the [illegible] nor the uniform movements of the eyes were [illegible] mal human beings exhibit in the Ritter and [illegible].

After the physicist has arrived at the idea that [illegible] canals are the organ of sensation of rotation or [illegible] tion, he is next constrained to ask for the [illegible] sensation of acceleration noticed in [illegible]

[1] *Anzeiger der Wiener Akad.*, 30 [illegible], 1875.

ing for an organ for this function, he of course is not apt to select one that stands in no anatomical and spatial relation with the semi-circular canals. And in addition there are physiological considerations to be weighed. The preconceived opinion once having been abandoned that the *entire* labyrinth is auditory in its function, there remains after the cochlea is reserved for sensations of tone and the semi-circular canals for the sensation of angular acceleration, the vestibule for the discharge of additional functions. The vestibule, particularly the part of it known as the sacculus, appeared to me, by reason of the so-called otoliths which it contains, eminently adapted for being the organ of sensation of forward acceleration or of the position of the head. In this conjecture I again closely coincided with Breuer.

That a sensation of position, of direction and amount of mass-acceleration exists, our experience in elevators as well as of movement in curved paths is sufficient proof. I have also attempted to produce and destroy suddenly great velocities of forward movement by means of various contrivances of which I shall mention only one here. If, while enclosed in the paper box of my large whirling apparatus at some distance from the axis, my body is in uniform rotation which I no longer feel, and I then loosen the connexions of the frame *rr* with *R* thus making the former moveable and I then suddenly stop the larger frame, my forward motion is abruptly impeded while the frame *rr* continues to rotate. I imagine now that I am speeding on in a straight line in a direction opposite to that of the checked motion. Unfortunately, for many reasons it cannot be proved convincingly that the organ in question has its seat in the head. According to the opinion of Delage, the labyrinth has nothing to do with this particular sensation of movement. Breuer, on the other hand, is of the opinion that the organ of forward movement in man is stunted and the persistence of the sensation in question is too brief to permit our instituting experiments as obvious as in the case of rotation. In fact, Crum Brown once observed while in an irritated condition peculiar vertigo phenomena in his own person, which were all satisfactorily explained by an abnormally long persistence of the sensation of ro-

tation, and I myself in an analogous case on the stopping of a railway train felt the apparent backward motion in striking intensity and for an unusual length of time.

There is no doubt whatever that we feel changes of vertical acceleration, and it will appear from the following extremely probable that the otoliths of the vestibule are the sense-organ for the *direction* of the mass-acceleration. It will then be incompatible with a really logical view to regard the latter as incapable of sensing horizontal accelerations.

In the lower animals the analogue of the labyrinth is shrunk to a little vesicle filled with a liquid and containing tiny crystals, auditive stones, or otoliths, of greater specific gravity, suspended on minute hairs. These crystals appear physically well adapted for indicating both the direction of gravity and the direction of incipient movements. That they discharge the former function, Delage was the first to convince himself by experiments with lower animals which on the removal of the otoliths utterly lost their bearings and could no longer regain their normal position. Loeb also found that fishes without labyrinths swim now on their bellies and now on their backs. But the most remarkable, most beautiful, and most convincing experiment is that which Dr. Kreidl instituted with crustaceans. According to Hensen, certain Crustacea [illegible] sloughing spontaneously introduce fine grains of sand [illegible] stones into their otolith vesicle. At the ingenious suggestion of S. Exner, Dr. Kreidl constrained some of these animals to [illegible] with iron filings (*ferrum limatum*). If the pole of [illegible] be then brought near the animal, it will at once [illegible] from the pole accompanying the movement with [illegible] motions of the eye the moment the current is [illegible] gravity had been brought to bear upon the [illegible] rection as the magnetic force.[1] This, in fact, [illegible] expected from the function ascribed to the otoliths. [illegible] covered with asphalt varnish, and the auditive [illegible]

[1] The experiment was specially interesting for me as I had [illegible] in 1874, although with very little confidence and without success, [illegible] magnetically my own labyrinth through which I had caused a current [illegible]

crustaceans lose their sense of direction utterly, tumble head over heels, lie on their side or their back indifferently. This does not happen when the eyes only are covered. For vertebrates, Breuer has demonstrated by searching investigations that the otoliths, or better, statoliths, slide in three planes parallel to the planes of the semi-circular canals, and are consequently perfectly adapted for indicating changes both in the amount and the direction of the mass-acceleration.[1]

I have already remarked that not every function of orientation can be ascribed exclusively to the labyrinth. The deaf and dumb who have to be immersed in water, and the crustaceans who must have their eyes closed if they are to be perfectly disorientated, are proof of this fact. I saw a blind cat at Hering's laboratory which to one who was not a very attentive observer behaved exactly like a seeing cat. It played nimbly with objects rolling on the floor, stuck its head inquisitively into open drawers, sprang dexterously upon chairs, ran with perfect accuracy through open doors, and never bumped against closed ones. The visual sense had here been rapidly replaced by the tactual and auditive senses. And it appears from Ewald's investigations that even after the labyrinths have been removed, animals gradually learn to move about again quite in the normal fashion, presumably because the eliminated function of the labyrinth is now performed by some part of the brain. A certain peculiar weakness of the muscles alone is perceptible which Ewald ascribes to the absence of the stimulus which is otherwise constantly emitted by the labyrinth (the labyrinth-tonus). But if the part of the brain which discharges the deputed function

[1] Perhaps the discussion concerning the peculiarity of cats always falling on their feet, which occupied the Parisian Academy, and, incidentally, Parisian society a few years ago, will be remembered here. I believe that the questions which arose are disposed of by the consideration advanced in my *Bewegungsempfindungen* (1875). I also partly gave, as early as 1866, the apparatus conceived by the Parisian scientists to illustrate the phenomena in question. One difficulty was left untouched in the Parisian debate. The otolith apparatus of the cat can render it no service in *free* descent. The cat, however, while at rest, doubtless knows its position in space and is instinctively conscious of the amount of movement which will put it on its feet.

be removed, the animals are again completely disorientated and absolutely helpless.

It may be said that the views enunciated by Breuer, Crum Brown and myself in 1873 and 1874, and which are substantially a fuller and richer development of Goltz's idea, have upon the whole been substantiated. In any event, they have exercised a helpful and stimulative influence. New problems have of course arisen in the course of the investigation which still await solution, and much work remains to be done. At the same time we see how fruitful the renewed co-operation of the various special departments of science may become after a period of isolation and invigorating labor apart.

I may be permitted, therefore, to consider the relation between hearing and orientation from another and more general point of view. What we call the auditive organ is in the lower animals simply a sac containing auditive stones. As we ascend the scale, 1, 2, 3 semi-circular canals gradually develop from them, whilst the structure of the otolith organ itself becomes more complicated. Finally, in the higher vertebrates, and particularly in the mammals, a part of the latter organ (the lagena) becomes the cochlea, which Helmholtz explained as the organ for sensations of tone. In the belief that the entire labyrinth was an auditive organ, Helmholtz, contrary to the results of his own masterly analysis, naturally sought to interpret another part of the labyrinth as the organ of noises. I showed a long time ago (1873) that every musical tone by shortening the duration of the excitation to a [illegible] gradually loses its character of pitch and takes on the character of a dry report or noise.[1] All the intervening stages between tone and noises can be exhibited. Such being the case, it will be readily assumed that one organ is suddenly and at some given [illegible] in function by another. On the basis of different experiments and reasonings S. Exner also regards the assumption of a special organ for the sensing of noises as unnecessary.

[1] See the Appendix to the English edition of my [illegible], Chicago, 1897.

If we will but reflect how small a portion of the labyrinth of higher animals is apparently in the service of the sense of hearing, and how large, on the other hand, the portion is which very likely serves the purposes of orientation, how much the first anatomical beginnings of the auditive sac of lower animals resemble that part of the fully developed labyrinth which does not hear, the view is irresistibly suggested which Breuer and I (1874, 1875) expressed, that the auditive organ took its development from an organ for sensing movements by adaptation to weak periodic motional stimuli, and that many apparatuses in the lower animals which are held to be organs of hearing are not auditive organs at all.[1]

This view appears to be perceptibly gaining ground. Dr. Kreidl by skilfully-planned experiments has arrived at the conclusion that even fishes do not hear, whereas E. H. Weber, in his day, regarded the ossicles which unite the air-bladder of fishes with the labyrinth as organs expressly designed for conducting sound from the former to the latter.[2] Störensen has investigated the excitation of sounds by the air-bladder of fishes, as also the conduction of shocks through Weber's ossicles. He regards the air-bladder as particularly adapted for receiving the noises made by other fishes and conducting them to the labyrinth. He has heard the loud grunting tones of the fishes in South American rivers, and is of the opinion that they allure and find each other in this manner. According to these views certain fishes are neither deaf nor dumb.[3] The question here involved might be solved perhaps by sharply distinguishing between the sensation of hearing proper, and the perception of shocks. The first-mentioned sensation may, even in the case of many vertebrates, be extremely restricted, or perhaps even absolutely wanting. But besides the auditive function, Weber's ossicles may perfectly well discharge some other function. Although, as Moreau has shown, the air-bladder itself is not an organ of equilibrium in the simple physical sense of Borelli, yet

[1] Compare my *Analysis of the Sensations*, p. 123 ff.

[2] E. H. Weber, *De aure et auditu hominis et animalium*, Lipsiae, 1820.

[3] Störensen, *Journ. Anat. Phys.*, London, Vol. 29 (1895).

doubtless some function of this character is still reserved for it. The union with the labyrinth favors this conception, and so a host of new problems rises here before us.

I should like to close with a reminiscence from the year 1863. Helmholtz's *Sensations of Tone* had just been published and the function of the cochlea now appeared clear to the whole world. In a private conversation which I had with a physician, the latter declared it to be an almost hopeless undertaking to seek to fathom the function of the other parts of the labyrinth, whereas I in youthful boldness maintained that the question could hardly fail to be solved, and that very soon, although of course I had then no glimmering of how it was to be done. Ten years later the question was substantially solved.

To-day, after having tried my powers frequently and in vain on many questions, I no longer believe that we can make short work of the problems of science. Nevertheless, I should not consider an "ignorabimus" as an expression of modesty, but rather as the opposite. That expression is a suitable one only with regard to problems which are wrongly formulated and which are therefore not problems at all. Every real problem can and will be solved in due course of time without supernatural divination, entirely by accurate observation and close, searching thought.

Ernst Mach.

Vienna, Austria.

SPECIES-FORMATION, OR THE SEGREGATION OF THE CHAIN OF LIVING ORGANISMS INTO SPECIES.[1]

THE DARWINIAN THEORY of selection furnishes no explanation of the formation of species. It contents itself with the assumption that intermediate forms perish because the newly originated, more perfectly adapted forms displant the old and less perfectly adapted ones. The indisputable objections which have been raised against this explanation are well known. Where the transformation is very gradual, as it is in the great majority of cases, the elimination of the intermediate forms, particularly if the modification affects only single individuals, is, owing to sexual intermingling, quite impossible without accompanying separation in space. But, as I have shown in the case of butterflies (*e. g.*, *Papilio Telemlaus*), new species do originate in the very heart of the distributional area of ancestral forms, and new species have unquestionably arisen everywhere, if not among yet alongside one another, without separation in space.

Darwin's selection cannot explain the transmutation of forms,

[1] Extracts from an address on *Orthogenesis* (i. e., definitely directed evolution) delivered at the Third International Congress of Zoologists at Leyden, September, 19, 1895; translated from Professor Eimer's MS. by T. J. McCormack. Professor Weismann's address which was delivered at the same Congress three days earlier and on a similar subject, appeared in *The Monist* for January, 1896, under the title *Germinal Selection*. It has seemed expedient therefore that the views of Professor Eimer, which represent the antagonistic position, should also appear in our pages. We regret that it was impossible to submit the proofs to Professor Eimer. —*Ed.*

nor the origin of new characters in forms; and no more can it explain the origin of species, despite the title of his celebrated book.

The origin of species can be traced to three main causes: (1) genepistasis, (2) halmatogenesis, (3) kyesamechania, all of which will receive their explanation in the following.

(1) By *genepistasis*, or cessation of development, I understand the halting of single forms at definite stages in the path of development whilst others move onward. *Epistasis*, the persistence or standstill of evolution at definite stages, is the main determining cause of the formation of species. It is solely through the operation of this cause that species are everywhere enabled to originate without separation in space. For orthogenesis, i. e., definitely directed and law-conforming evolution, produces the simultaneous transmutation of *numerous* individuals of the same species. And when a large number of individuals thus push onward in their developmental path whilst others remain behind, unavoidably a new species must originate. The evolutionary advancement of a large number of individuals can, therefore, take place in the very heart of the distributional area of the species, provided the advancing individuals are more sensitive than their fellows to the outward influences that condition the transmutation. But the farther the influences under consideration, viz., climatic and nutritional conditions, are removed from the centre of the distributional area of a species, the more powerful is their transformative effect. And the facts of variation for any given species do really show more aberrations and varieties as we recede from the centre of its distributional area, while still farther away new species are observed.

But, conformably to the law of *heterepistasis*, or the cessation of development at *different stages*, single characters may in transforming suffer suspension at a lower stage of development whilst others continue to advance. Heterepistasis appears to me a means of high import for insuring the stability of perfected species and one which is more determinative the higher and more complex the organism is. The interaction and interconnexion of so many widely diverse characters in their capacity as a totality is bound to insure the permanence of the whole for the reason that the characters in

question must necessarily counterbalance each other, seeing that by the very reason of their union as a whole each could not well be transformed by itself, just as in the pendulum of a standard clock the bars of different materials compensate each other during expansion and contraction.

On the other hand, simple organisms, in which few tendencies of development are as yet active, will give rise to less pronounced species, since here the developmental tendencies may even become reversed (*Foraminifera*).

But epistasis, or persistency of evolution at definite stages, is of paramount importance for the origin of species and varieties in the further respect that any individual characters whatever may in the course of enormously long periods of time make their reappearance by way of "reversion" as specific characters. For example, in the plumage of birds there sometimes reappear as specific characters markings which were specific characters in far distant and not at all immediately related ancestors or which only occurred in the down of such ancestors. We are concerned here, accordingly, not with ordinary reversion, which is an occasional phenomenon only and has nothing to do with the characterisation of new species, but with permanent reversion, with permanent phyletic reversion.

At times such old characteristics reappear only in one sex, particularly in the male, when we have permanent male phyletic reversion. Occasionally they appear only in some one part of the covering, for instance, in the ornamental part, or during transformation in the transitional part, when we have metamorphic or transformative reversion.

Such permanent reversion is to be conceived as epistasis or persistence, because the character in question, being according to the biogenetic law subject to repetition during individual development as an inheritance from ancestors, but being only fugitively repeated in the immediate progenitors of the retrogressive species and never making its appearance at all in the adult individuals,—this character, we say, persists and makes its appearance as a distinctive mark of the perfected species.

The explanation of ordinary reversion or atavism, personal

or individual reversion, is implicitly involved in the foregoing. There is concerned here merely the persistence or permanence of single characters, which according to the biogenetic law were obliged to appear only evanescently during ontogenesis, thereafter making way for others.[1]

Atavism is thus naturally classified with the remaining laws of persistence enunciated by me and is explained by them and the biogenetic law jointly. It is simply heterepistatic, ontogenetic, personal cessation of development.

Likewise permanent phyletic reversion is heterepistatic cessation of development—not ontogenetic but phylogenetic. We may characterise the two species of reversion most simply as ontogenetic and as phylogenetic reversion, or as ontogenetic and phylogenetic epistasis or heterepistasis. Both differ from the species-originating process known as genepistasis by the fact that genepistasis signifies a cessation of all the characters embraced by a given definite direction of evolution, the arrestation lying entirely outside of ontogenesis. We enter here again the domain of orthogenesis to which both ontogenetic and phylogenetic reversion ultimately belong.

The biogenetic law,[2] also, is the expression of definite directions of evolution in so far as these have not been altered by the use or disuse of organs in ancestors. Naturally it holds good not only for ontogeny but also for metamorphosis or the period of development persisting after birth or after emergence from the egg. We see here, for example, in the markings of lizards, how one marking is replaced by another in the direction from behind forwards (postero-anterior development, law of undulation), and how the females usually preserve the youthful characters longest or for good, whilst the males first assume new characters (male preponderance). Male

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[1] Compare H. Kohlwey, *Das Gesetz der Vererbung, Blätter für Geflügelzucht*, 1886, where the same idea is uttered.

[2] Hyatt is of opinion that the biogenetic law was discovered not by Haeckel but by Agassiz. As a matter of fact, it had been previously clearly and definitely enunciated by Kielmeyer, Mechel, and other Germans. Compare also Schopenhauer, *Parerga*, II., p. 168.

preponderance is simply the advance of the male one evolutionary step further along the path of orthogenesis. In numerous animals investigated by me, the old original characters are found permanently at the front in a fully perfected state, whilst the new ones are found at the rear; as in the markings of lizards, of birds of prey, Papilionidæ, etc. In the sculpturing of ammonites and snail shells the old characters are found on the most primitive whorls, the new characters on the whorls that appear latest.

Perfectly analogous examples may be adduced for plants with respect to the succession of leaves.

A second important cause of the segregation of the natural chain of organisms into species is:

2. *Saltatory development* or *halmatogenesis*, which consists of the sudden, unsolicited appearance of new characters, or, where a large number of such new characters appear, of the sudden origin of new forms that deviate widely from the ancestral form. To what extent direct outward influences are operative here is demonstrated by many facts, such as the sudden, *kaleidoscopic* transmutations of the markings and colorings of butterflies through the agency of heat or cold during development (including horadimorphism or seasonal aberration), the sudden transmutations due to nutrition or general outward conditions of life, as those determinative of the origin of *Amblystoma*. So, too, the conversion of *Artemia salina* into *Branchipus* (Schmankewitsch) shows sudden, graded transmutations. Everywhere here correlation appears as one of the most effective causes of the transmutation of forms.[1]

That separation in space is an influential factor in the origin of species follows immediately from my doctrine of the genepistatic formation of species, and from the effect of outward influences upon transmutation.

Outward influences in their action on genepistatically segregating forms are enhanced as to species-creating power, or as to their power of promoting the creation of species, according as

[1] A distinction is to be made between the kaleidoscopic correlation which is here operative and the functional correlation of Cuvier which relates to the use of parts

separation in space keeps the originating species and the ancestral species absolutely apart, or absolutely prevents sexual intermingling. But no direct, independent significance can be accorded to separation in space as a factor in the formation of species.

As already said, the formation of species may take place in the very heart of the distributional area of the ancestral form, and so be conditioned solely by genepistasis.

Of the highest significance for the formation of species without separation in space, however, is the following factor:

3. *Kyesamechania*,[1] or hindrance to impregnation, the inability of a certain group of individuals to impregnate others than themselves, due to morphological or physiological changes in the seed or ovum or both, or to a change in the time of maturity of the seeds or ova. Changes of this kind occur mainly through correlation, through indirect influence on the sexual organs.

I referred to the phenomenon of prevention of impregnation as early as 1874.[2] Some time later (1886) George J. Romanes lighted upon the same idea and under the name of physiological selection contrasted prevention of impregnation as a factor in evolution with the origin of species by natural selection.[3]

The main factor, finally, that conditions and promotes the formation of species is the activity, the continued use of certain organs. The same result may be obtained by intercrossing, though ordi-

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[1] From κύησις, impregnation, and ἀμηχανία, incapacity.

[2] First in *Zoologische Studien auf Capri. II. Lacerta muralis coerulea*, Leipzig, Engelmann, 1874, p. 45. Then in *Zoolog. Unters. mit bes. Berücks. d. Biologie, I. üb. Bau u. Bewegung d. Samenfaden*, Würzb., Stahel, 1874, p. 42, and *Würzb. Verh.*, 1874. Also in *Varilern d. Mauereidechse*, 1881, p. 257, and in *Entstehung d. Arten*, I., p. 45. In prevention of impregnation there are concerned, according to my opinion, the two following factors: (1) mechanical causes, involving (not to mention such as are founded in the rough structure of the sexual organs) (a) the size of the spermatozoa or the breadth of the oviducts or the varying stoutness of the integuments of the ova, and (b) the varying power and form of movement of the spermatozoa which according to my observation is in vertebrates performed in screw-like motions mostly rotatory. The spermatozoa are, in fact, in closely allied species widely different as to shape and movement. (2) Physico-chemical differences in the composition of sperm and ovum.

[3] *Journal of the Linnean Society*. Zoölogy, London, 1886. *The Monist*, Vol. I., No. 1.

narily this has a levelling and hindering effect in the formation of species.

As for the rest, species are not originated by natural selection but already existing species are preserved by natural selection.

I accept in this unreservedly one part of Darwin's conceptions, as it is stated in the inscription of his book on the origin of species which reads: "The origin of species by means of natural selection, or, the *preservation of favored races in the struggle for life.*"

DEMONSTRATION.

I shall extract the proofs for the views which I have here enunciated, from the facts furnished in my *Formation of Species and the Relationship of Butterflies*, as found in the recently published second part of this work, containing "the forms allied to the Swallowtails."

I distinguish between three groups of Swallowtails: the *Turnus*, *Machaon*, and *Asterias* groups. These groups contain mostly American forms and preponderantly North American forms. *Alexanor* alone in the *Turnus* group occurs in Europe and Asia; the *Machaon* group is represented in Europe, North America, Asia, and Africa. Further, all three live in connected distributional areas and are also all three immediately connected in relationship. The North American *Papilio Eurymedon* belonging to the *Turnus* group, or some similar ancestral form of this same group, forms the starting-point of all the others and at the same time connects them with the *Segelfalter* (*Papilio podalirius*). The relationships involved are mainly inferred from the markings, but the other characters all follow these: venation does not appear to be entirely determinative of the markings. We can tell from the markings, coloration, and shape at once that relationship follows geographical distribution, the fact being that at every remove from the main seat of the phyletic types no matter how small, the forms represent more and more distantly related varieties or species. As we have already demonstrated in the case of the *Segelfalter*, so also in the case of the *Swallowtails*, as a glance at the Plates of the last-named work will show, variations of individuals pass in adjacent areas into aberrations, and in more remote areas into species. The same Plates

(*Swallowtails*) also show that everywhere definite directions of development are determinative of the transmutation. By them are produced, first individual modifications in single forms of a species (aberrations), then varieties, and finally again, species. Now all these directions of development which lead to the origin of aberrations, varieties, and species, have nothing to do with origin by natural selection, nor with sexual selection. The new forms arise without the least regard for utility; every new form of butterfly shows for itself the absolute impotence of natural selection. On the other hand, the facts of geographical distribution with respect to relationship show very distinctly that outward and especially climatic conditions must have been coincidently determinative in the formation of species. This is proved by the fact that *artificial temperatures produce exactly the same directions of development or modifications thereof as the same butterflies exhibit in their actual geographical distribution.* This has been recently shown with perfect clearness by the researches of Standfuss, who by causing heat to act on the pupæ of *Papilio Machaon* in Zürich, produced butterflies such as are found in August in Syria. And here not only changes of coloration and marking but also those of shape as produced by heat in the pupæ agree with the southern forms.

Additional proof of the correctness of my view is furnished by the facts of seasonal aberration, and first by the fact that the summer forms everywhere correspond to the forms artificially produced by heat, and secondly by the fact that the characters of the summer forms of species living farther towards the North are the same as, or closely similar to, the distinguishing characters of allied butterflies which live in the South.[1]

The experiments of Standfuss, Merrifield, and Fischer, as well as the facts which seasonal aberration furnish, show that the explanation which Weismann has advanced regarding the origin of *Vanessa Levana* being a reversion cannot hold water, that this is also true of his explanation of the origin of the dark form of

[1] Compare especially the first part of my *Schmetterlinge*, Sec. "Die Segelfalterähnlichen."

Polyommatus Phlæas, and finally that in all the consequences of the action of heat and light on butterflies we are concerned simply with the *inheritance of acquired characters*, which it was his special object to overthrow.

"On the plates of my butterflies the formation of species and the laws of evolution can be read directly from the wings. The markings and colorings of the same are so many letters speaking a clear and forcible language that no one who wants to know the truth can misunderstand. Like the leaves of an open book the written characters on the wings of our butterflies show their past and present history."

"Here on the tablets of the laws which living nature has placed in our hands, the truth of evolution lies written, and not in the writings of the naturalist philosophers who dream their evolutionary fancies with an utter disregard of the facts, and who scatter them among their credulous followers in unremitting profusion. Mind-made hypotheses are not investigations of nature. No hypothesis is justified in natural inquiry unless it rests upon facts. The man who scorns facts is no natural inquirer." Such were my words in the Preface to my *Swallowtails*.

This handwriting tells us in the most convincing and palpable manner, how one species passes into another, and how the species are segregated. Nowhere has the actual origin of species and the connexion of a concatenated series of species been hitherto so forcibly exhibited and demonstrated as here.

Let us look at the facts more closely.

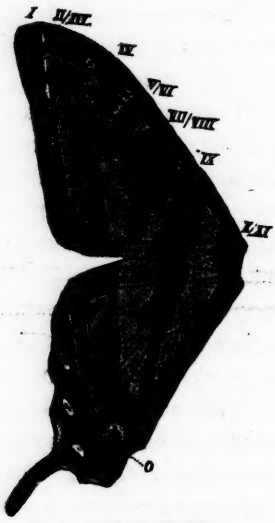
In the first part of my *Artbildung und Verwandtschaft bei den Schmetterlingen*, in the Section on *Die segelfalterähnlichen Papilioniden*, I have derived the last-named butterflies from forms which had eleven longitudinal stripes on their wings, such as are still shown to-day by certain species like *P. Alebion*, *Paphus*, *Glycerion*. Now these longitudinally striped[1] butterflies give, as I am becom-

[1] The objection has been raised on many sides that what I call longitudinal striping in butterflies is really a transversal striping of the wings. And this is quite correct if we speak of the marking of only a single wing. But I speak of the marking of the entire butterfly, of its body, and its two wings, of the front and the hind

ing more and more convinced, the fundamental form of marking of all diurnal butterflies. Partial or total disappearance, broadening and fusion of the fundamental bands condition the formation of the characteristic marks of aberrations, varieties, species, and families. From the transformations of the fundamental bands and the intervening spaces, the ocellated spots also are produced.

In the majority of *Segelfalter* some of the eleven bands have already disappeared or have been shortened from behind forwards.

Cut 1. *Papilio Alebion* GRAY.



Cut 2. *P. Eurymedon* BOISD.

The case is similar with those Swallowtails which are their nearest relatives.

I reproduce here a representation of *Alebion* from above[1] with

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wings as integral parts of a whole. That the wings are a whole with respect to marking is proved by the connexion of the marking in front and behind, in the position which the wings assume when spread out and where the marking and the coloration, owing to the hind wings being covered by the fore wings, are partly wanting. The connexion in question is likewise proved by the mode of transformation or disappearance of the markings from behind forwards, from the hind wings to the fore wings; in other words, by the existence of general laws of marking in such transformation. For details see my *Artbildung*, II., 48, 49.

[1] In the following cuts the left wings always give the upper sides, the right wings the under sides.

its eleven fundamental bands marked by capital Roman numerals, designations which I have everywhere employed in my *Artbildung und Verwandtschaft bei den Schmetterlingen*, and which I shall also lay at the basis of the description to follow. For all the markings of the diurnal butterflies can be traced back to these bands and to the black coloration of the veins.

Also the following cuts of the Swallowtails have been taken from my *Artbildung*. In the footnotes added to the descriptions will be found numbers and plates referring to the corresponding colored cuts of the last-mentioned work.

The form of living Swallowtails which in most likelihood is nearest allied to the initial form of the group, and which is most nearly connected with the *Segelfalter*, namely *Papilio Eurymedon* (Cut 2), has as yet only seven longitudinal stripes; the remaining ones have partly disappeared and have partly been fused at the sides. As in the *Segelfalter*, they disappear in the succeeding species, by orthogenesis, from behind forwards, conformably to the law of postero-anterior development, *Papilio Turnus*, *P. Alexanor*, *P. Machaon*.

In *P. Alexanor* there are, as Cut 3 on p. 108 shows, still seven stripes present either in part or in whole, I, II, III, V/VI, VII/VIII, IX, XI. V/VI is, here as always, situated on the fore wings at the outer border of the middle cell. IX forms with XI an angle, and is on the under side frequently colored black, white, and red, or black, white, and yellow ("ornamental band"). *C* on the outer border of the middle cell of the hind wings like V/VI is here as in other families, *e. g.*, in the Pierids, an extremely important marking, in its origin probably a component part of VII/VIII, which in some *Segelfalter* reappears rudimentarily but in the Swallowtails is a pronounced "*C*-marking."

The remaining transformations of the bands of Swallowtails are the consistent expression of the general law of markings, first in that they exhibit spots which are due to abridgement and lateral fusion as in *P. Machaon* in Europe and North America,[1] and further

[1] Plate VI. Fig. 8.

in that they show rudiments of transversal stripings induced by the blackening of the cross veins (noticeable in other specimens of *Machaon*). These rudimentary transversal stripings are by other agencies subsequently perfected, as in the case of *P. Xuthus* and *Xuthulus.*[1] Here, on both sides of the wings, and that, too, in the forward middle cell, a transversal striping makes its appearance (*a*, Cut 5).

In *P. Hospiton* (Cut 7) there is a rudiment of this new marking present.

Finally unicoloration arises, as follows. The dark coloring

Cut 3. *Papilio Alexanor* Esp. ♀.

Cut 4. *Papilio Machaon bimaculatus* m.

which has made its incipient appearance at the inner wing-angle of *Machaon* extends systematically outwards over the wings and ultimately covers their entire surface, excepting a few spots at the border (*Asterias* group, Cut 6).[2]

We have accordingly a simplification of marking and coloring in the higher forms and not a perfection, as Nägeli's theory and as sexual selection would require. The same holds true of the tails of the hind wings which in the higher forms are not lengthened but shortened. And both facts hold true of the *Segelfalter*.

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[1] Plate VI. Figs. 9 and 10.

[2] Plates VII. and VIII.

The directions of development of these markings show accordingly in their systematic conformity to law the same detailed tendencies as are determinative in animals quite unallied to the butterflies, as in mammals, birds, lizards, mollusks, etc.

The gradual transformation of the markings takes place therefore, as the cuts and particularly the plates of my book show, for the most part through the disappearance, shortening, and lateral fusion of the bands, in which process the upper side as a rule is considerably in advance of the under side which largely retains

Cut 5. *Papilio Xuthus* L. (Under surface.)

Cut 6. *Papilio Asterias* Cram. ♀.

the earlier and more primitive condition,—a result the very reverse of that demanded by the theory of adaptation for diurnal butterflies.

In addition, new bright colors and color-markings and embellishments make their appearance, at first mostly as before on the upper surface, as the bright blue inner marginal band which conformably to postero-anterior development first appears at the back and developing itself on the hind wings afterwards advances forwards (*P. Turnus*, Plate V, *Machaon*,[1] *Asterias*-group[2]). And if

[1] Plate VI. [2] Plate VII.

this band is more pronounced and more beautiful on the under side than on the upper, on the other hand it did not make its appearance there until subsequently when it was either on the verge of disappearing above or had already disappeared (*P. Troilus*,[1] *Palamedes*[2]).

At the inner angle of the hind wings, the ornamental hinder eye, as in the *Segelfalter*, is developed from portions of the mar-

Cut 7. *Papilio Hospiton* GÉNÉ. Under surface.

The three *o*'s on the hind wing indicate the points where orange-red (reddish-yellow) spots lie.

Cut 8. *Papilio Daunus* BOISD ♂. Under surface.

The four *o*'s on the interior of the hind wings show the places where orange-red spots are situated.

ginal bands, as comparison with the more primitive under side frequently shows, e. g., *Papilio Hospiton* (compare Cut 7 at the point *o* outside the Cut).[3]

Quite remarkable is the slow, systematic production from a fragmentary black band, of a black nucleus in the orange-red hinder eye, particularly in *Machaon* and *Asterias*. Whilst the upper side

[1] Plate VIII. Fig. 2, [2] *Idem*, Figs. 3 and 4, etc. [3] Plate VI. Fig. 6.

is usually in advance of the under side in development, the reverse also takes place, as, for example, in the production of orange-red spots, which again originate first on the posterior part of the hind wings within the innermost black marginal band in the cells of the wing on the under side,[1] as in *P. Machaon* and in *P. Hospiton* (*o*, Cut 7),[2] and further in *P. Turnus*, *Daunus* (the four inner *o's* on the hind wings of Cut 8[3]), and which gradually increase in intensity of color and in magnitude, to spread finally over the wing cells of the

Cut 9. *Papilio Asterias* var. *Calverleyi* GROTE.

The *o's* indicate two series of reddish-yellow spots. The *a* shows the nucleus of the hinder eye-spot.

Cut 10. *Papilio Turnus* L. ♀.

fore wings (*P. Brevicauda*, *P. americus*, *P. Hellanichus*[4]). In the last-named butterfly they are also present on the upper side, as they are in *Calverleyi* (*o* on the hind wing, and corresponding neighboring spots, Cut 9).[5]

It is noteworthy of *P. Turnus* that these spots appear first more prominently in the female.[6] In *P. Bairdii* the reverse is the case.[7]

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[1] Plate V., VI. [2] Plate VI. [3] Plate V. [4] Plate VII.
[5] Plate VIII. [6] Plate V. Fig. 2. [7] Plate VII.

Similarly in the sulphur-yellow spots of the outer marginal band orange-red dots make their first appearance underneath (*Turnus*). In the higher forms these spots are found only in the cells of the fore wings and have disappeared (Cut 9) in the two hind wings (*P. Asterioides* and *Asterias*).[1] The foremost of these spots is in *Turnus* carried over to the upper surface (compare Cut 10, the *o* to the front), as also in *Troilus*;[2] and in the same place, as also rudimentarily in the remaining cells of the hind wings as well as in the hindmost cell of the fore wings, a like coloring appears also in *P. Machaon asiatica*,[3] and it is this coloring that everywhere produces the orange-red of the hind eye-spot in the innermost cell of the hind wings (e. g., *o* in *Turnus Glaucus* ♀, Cut 19, *a* in *Papilio Bairdii* ♂, Cut 15).

An extremely remarkable direction of development in the transformation of the markings is manifested in the fact that on the under surface of *Machaon* rudiments of that streaking of the middle cell of the fore wings first appear which in *Xuthus* and *Xuthulus* become more pronounced in development, are present on both sides, and constitute a prominent characteristic of this species (compare *P. Hospiton*, Cut 7, *P. Xuthus*, Cut 5, and *Hippocrates*,[4] also *P. Machaon æstivus*).

Numerous other systematic and law-conforming transformations of marking and coloring might readily be cited.

Instead of doing so, however, we shall proceed to examine a few *newly appearing* characters in our Swallowtails.

The new characters in question make, as I have already shown for the *Segelfalter*, their first appearance in a very inconspicuous and scarcely perceptible manner. Like all other modifications they are first produced in single butterflies of a species only as aberrations, then they appear as characteristics of varieties, and finally as marks of species.

In this manner certain tiny black dots make their appearance in the cells of the fore wings of Swallowtails, at first partly as marks

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[1] Plate VII. [2] Plate VIII. Fig. 2. [3] Plate VI. Fig. 7. [4] Plate VI.

distinguishing aberrations and partly even as such distinguishing species.

For example, in the forked cell of *Machaon* there is found, usually at both sides, but always on the upper surface, a black point or spot, which is also present and has become a mark distinguishing the species in *Xuthus* and *Xuthulus* and in several members of the *Asterias* group (compare *P. Hospiton*, Cut 7, at *G*; *P. Machaon bimaculatus*, Cut 4; *P. Xuthus*, Cut 11; *P. Bairdii* ♂, Cut 15). In *P. Turnus* ♀ and in *P. Alexanor*, etc., there is found in place of

Cut 11. *Papilio Xuthus* L. (Upper surface.)

Cut 12. *Papilio Machaon asiatica* Mén.

Cut 13. *Papilio Palamedes* Dru. ♂.

Hind wing, under surface. *br*, brownish-red. *b*, blue (blue marginal band).

this an outwardly protruding fragment of band IV.,[1] from which it has doubtless originated. In many *Machaon* (e. g., *Hospiton*) the black spot acquires as a new character a bright space in its centre (compare the cut).

So also in the bright interior of the first lateral margin-cell which lies just behind the forked cell, is sometimes found a very

[1] In the address as printed in the *Compte-Rendu*, page 163, band IV. reads erroneously band V/VI.

small but very distinct dot in some of our native *P. Machaon* (compare *P. M. bimaculatus*, Cut 4). It is likewise found in a butterfly of Allahabad.[1] In *P. Xuthus* (compare Cut 11) it is always present on the upper surface and only seldom as a small transversal streak; it is usually found as a large oviform spot, and from the marking which appeared in *Machaon* as an aberrational phenomenon it has in this last stage been converted into a conspicuous and distinguishing mark of the species.

A new phenomenon is the appearance of a dark outward border on the middle cell of the hind wings, which on the under surface of *Turnus* occupies the entire outer margin, but on the upper surface makes its appearance only as a black line of varying shortness —the *C*-marking as I have termed it and which is very conspicuous for example in *P. Turnus* ♂ (Cut 10 *C*), *Daunus* (Cut 8), *Pilumnus*, but particularly in *Alexanor* (Cut 3 *C*). In *Daunus* ♀ it is present only on the under surface; in the majority of *P. Machaon* the entire border of the middle cell is black also on the upper surface, as it is also in the majority of *Asterias*.[2]

Another new character is the black nucleus in the hinder eye-spot which is already pronounced in appearance in many members of the *Machaon* group, e. g., *P. Zolicaon* and *P. Machaon var. oregonia*, and then in *Asterias*, and whose origin from a fragment of marginal band has already been mentioned. We recognise the first stage of its production in Cut 19 representing *P. Turnus Glaucus* ♀, just above the letter *g*; in *P. Machaon asiatica* (Cut 12) at the letter *a*, and in *P. Palamedes* ♂ (Cut 13 representing the under surface). A more advanced stage is seen in *P. Bairdii* ♂ (Cut 15), to the right above *a*. The nucleus of the hinder eye-spot is completed, that is, perfectly marked off, in *P. Bairdii* ♀ (Cut 18), *T. asterioides* ♂ (Cut 16, both times at *a*), *P. Xuthus* (Cut 11), etc.

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[1] Compare for the case of *Machaon* Cut A at page 26 of my *Swallowtails*.

[2] Colored and even red borders of the outward angle of the middle cell of the hind wings were observed even among the *Segelfalter* in the case of *P. Protesilaus* (*Segelfalter*, Plate I. Fig. 5), but without assuming any further import. As for the rest it was pointed out that the *C*-marking was probably a reappearance (reversion) of a fragment of band VIII.

A new and very marked character, distinguishing the majority of Swallowtails in the broadest sense, finally, is the blue marginal band, the blue spots of which are marked *b* in a number of the following cuts (*P. Bairdii*, *Turnus Glaucus*, ♀ *Palamedes*, *Daunus*, *Asterias*).

Part of these new characters, which in the end appear as fresh marks distinguishing the species, is accordingly to be regarded as a transformation of old characters, whilst another part is entirely new.

Now these new characters, viz., the tiny dots and lines here making their first appearance, can be observed in their first, primitive origin, and can be followed in their development from almost imperceptible markings as they appear here and there in individuals of a species, until they have become fixed as permanent marks of a different species. The ids and determinants of Weismann cannot be seen. But one can palpably and irrefutably see in the faint dots here considered that the transmutation and origin of a species has taken place in diametrical opposition to the theory of determinants. The same is proved by all transformations of existing characters into new distinguishing marks of species. The origin and perfection of new characters, the transmutation and origin of species, take place conformably to law in a few, quite definite directions without any "oscillation"[1] whatever, without any reference to utility; they demonstrate, in fact, the absolute impotency of natural selection in this domain.

One can read from my plates how all the characters of the different varieties and species of swallowtailed butterflies have arisen one from another by orthogenesis. Every variety or species is distinguished by a definite total of characters which have originated orthogenetically from the most inconspicuous beginnings, which through heterepistasis on the one hand, homöogenesis on the other, and finally through halmatogenesis, have been developed and compounded now in this manner, now in that; whilst the upshot of the whole shows that the origin of species essentially re-

[1] See *Germinal Selection*, p. 20, where Weismann contends that the variations presented to selection "oscillate" about a given zero-point.—*Trans.*

poses on genepistasis or cessation of development at different single stages of the evolutionary advance, the process being that one species thus always presents a higher stage of development in its characters than another.

That utility plays no part whatever in the process follows from the nature of the determinative characters themselves, but is particularly demonstrated by the following considerations: (1) In different species of the same phylogenetic line, the various stages of these characters never occur in the same perfection or arrangement; (2) they are equally determinative in different parallel chains of species; (3) they also occur side by side in different sexes in different development; (4) they occur in the same development in different species of one phylogenetic line—apart from the fact that (5) they everywhere make their appearance in the most inconspicuous beginnings, are preserved in faint forms of perfection as distinctive marks of species and may disappear again, and that (6) the complete reversion of all characters so originating, or their concealment through being colored black, that is perfect simplification, may arise.

The significance of heterepistasis for the origin of species is everywhere forced on our notice by my cuts, and I shall draw attention here only to a few special conspicuous features.

In *Machaon* the uniform black coloration of the upper surface of the roots of the forewings has become characteristic of the group. In *Xuthus* and *Xuthulus* this character has not reached its full perfection, although the reverse is the case with the striping of the middle cell of the fore wings, which is rudimentarily indicated only in a few *Machaon*, not having attained there further development. *Hellanichus* receives a very special character from the running over of the orange red color-spot on the under surface of the wings to the upper surface. The *Turnus* have lost much of their original marking, in that the original longitudinal stripes have been not only shortened from behind forwards, but also diminished in width. Particularly the male of this butterfly,[1] which has advanced quite

[1] *Artbildung*, Plate V. Fig. 6.

far in transformation, has been made very bright in this manner. Also in *Machaon* the longitudinal stripes have disappeared from the back to the front, but in this instance the black coloring of the transverse veins has set in.

The widening of the residual stripes of the fore wings and the black coloration on the upper surface of the roots of the same by the fusion of the longitudinal stripes points to a direction of development which is the opposite to that in *Turnus*.

This last direction of development, the appearance of a uni-

Cut 14. *Papilio Turnus* L. ♀.

Cut 15. *Papilio Bairdii* EDW. ♂.

form black coloration on the roots of the fore wings, which even in *Machaon* had begun to extend to the hind wings, continues to spread in *Asterias* to both wings, and in the *Asterias* group makes for unicoloration or perfect black coloration. This progressive blackening offers, coincidently with two instances of saltatory development (halmatogenesis), conspicuous examples of independent similarity of development, homöogenesis, and of female preponderance, whereas otherwise male preponderance is usually determinative. The same phenomena suddenly assumes in *Bairdii* ♀ and in *Turnus var. Glaucus* ♀ so advanced a stage as to ex-

tend over the entire wings with the exception of a few spots, whereas the average female of *Turnus* is sulphur-yellow in its ground color like the male, and whereas in the males of *Bairdii* the black coloring is only somewhat more extended than in *Machaon*. In other words, the phenomenon which in *Bairdii*♀ and *Turnus Glaucus* spasmodically and suddenly developed, and only in the female, was, beginning with *Machaon*, gradually perfected in the *Asterias* group in both sexes. The black coloring kept extending here from species to species, beginning at the roots of the wings and spreading over their entire surface, at last leaving be-

Cut 16. *Papilio asterioides* Reak. ♀.
b and the three spots situated in the wing cells just above are blue (blue marginal bands).

Cut 17. *Papilio Asterias* Uram. ♀.

hind it only bands of spots of the ground color,—the same as were left in *Bairdii*♀, whilst in *Turnus Glaucus* even these were lost.

The butterflies represented in Cuts 14 to 19 show accordingly a series of different stages of law-conforming transmutation of species, which exhibit not an advance towards beauty and variety, but an advance towards simplicity, towards dark and sombre colorings, such as I have described among the *Segelfalter*, and such as appear widely distributed as we shall see later on among other groups of butterflies. Sexual selection, as being on the face of it absolutely excluded so far as the markings and coloration of butterflies are concerned, is nowise involved here, nor is there any

ground for believing that selection or adaptation is in any way concerned.

The species *P. americus, Nitra, Indra, brevicauda, asterioides,* and *Asterias* figured on Plate VII. of my *Schwalbenschwanzähnliche Schmetterlinge,*[1] show a complete serial line of transformations within the *Asterias* group, and are at the same time conspicuous examples of genepistasis. The highest degree of transformation in this series has been reached by *Asterias,* a species which is almost as far advanced as *Bairdii* ♀. *P. Troilus*[2] is almost as far ad-

Cut 18. *Papilio Bairdii* Edw. ♀.

Cut 19. *Papilio Turnus Glaucus* L. ♀.

vanced on the other side and represents an instance of heterepistasis as does also *Palamedes.*

We have figured still another butterfly which is most likely a conspicuous instance of halmatogenesis: *Papilio Asterias var. Calverleyi,* Cut 9,[3] which according to Edwards is probably a cold form of *Asterias.* It has been transformed towards the *Machaon* type in

[1] The cuts given in the present article are in fact a makeshift only, for the purpose of explaining the description. I must refer to the plates of my *Artbildung,* etc., for a full understanding of the facts.

[2] Plate VIII. Fig. 2. [3] Plate VIII. Figs. 5 and 6.

such wise that the black occupies only the inner part of the wings, whilst the broad outward parts of the same have turned yellow or orange-red, the latter color appearing on the hind wings, where the orange-red coloring of the wing-cells which in various other species of the *Asterias* group has been specially developed on the under-surface, attains great importance also on the upper surface.

The black *P. Turnus Glaucus*♀ is as compared with the common bright female type of *Turnus* a more southern form living in warmer regions, so that here also climatic conditions seem to be decisive of transformation. This does not hold, however, for the dark *Asterias*, for these occur also in colder regions. Since female preponderance is determinative of the transformation in *Turnus Glaucus* and in *Bairdii*, and since this transformation corresponds entirely to that of *Asterias*, therefore the influences upon the weaker female sex which in this case is more sensitive must be sought as the cause of the transformation, and the more so because *Glaucus*♀ appears also in the North in isolated cases among the common *Turnus*.

The facts here presented also afford a conspicuous example of the ease with which mimicry may erroneously be assumed and notoriously has been assumed by writers who need it in its full extent for the substantiation of their hypotheses. In the many various species of the *Asterias* group we should have the most beautiful instances of mimicry imaginable, were it not that these species have developed and are now living entirely without biological connexion. What perfect specimens of mimicry *P. Turnus Glaucus*♀, *Asterias*, *Bairdii*, etc., would present to the enthusiastic devotee if he could only furnish the facts of biological connexion! Finally, in strict agreement with the instances which the devotees of mimicry have put forward, not only all the members of the *Asterias* group but also all of the *Machaon* and all of the *Turnus* groups must be regarded as mimetic. And I should scarcely be surprised if Pseudo-Darwinism were really to advance this contention.

It will immediately be evident to the unprejudiced observer, however, that the resemblances are the result of developmental

tendencies, and that independent sameness of development or homöogenesis is determinative of likeness, even in not immediately related forms.

As a fact, there is no doubt in my mind, that when the data have been carefully sifted, it will certainly be shown that by far the greater majority of cases of so-called mimicry have nothing to do with adaptation. It was to this purport that the entomologist Hahnel spoke long ago, from actual numerous observations which he had made in South America in nature; whereas Erich Haase[1] without having looked to actual nature at all, has recently set up no end of cases of mimicry on the basis of outward similarity between butterflies, and wrote a whole book on the subject. But it stands to reason that resemblances of this character, quite apart from the question of their origin, can prove nothing for adaptation. The demonstration of adaptation in nature itself is alone decisive.

As to the origin of actual cases of mimicry the same cannot possibly be explained by selection, and what Herr Weismann has recently said[2] about *Kallima* as a marvellous product of selection loses all its demonstrative force when opposed to the plenitude of facts which go to show that orthogenesis everywhere determines the shaping of characters and is in this manner enabled to produce the resemblance to a leaf on the under-surface of a butterfly, and that homöogenesis is able to bring about the greatest resemblance between two butterflies which do not live together at all—a phenomenon of which numerous cases are known.[3] There is similarly nothing marvellous about the systematic and proportionate extension of the leaf-marking of *Kallima* from the fore wing to the

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[1] Erich Haase: *Untersuchungen über die Mimicry auf Grundlage eines natürlichen Systems der Papilioniden.* Kassel, 1894.

[2] International Congress of Zoologists at Leyden, Sept. 16, 1895. *The Monist*, Jan., 1896. *Germinal Selection*, Chicago, 1896.

[3] Piepers in the entomological section of the Leyden Congress of 1895 referred to cases of this kind. Thus, *Junonia Asterie* of Java is like our *Hipparchia Megæra*, and *Junonia Erigone*, of the same locality, resembles our *Hipparchia Egeria*, so that in both cases mimicry would would have been assumed if the like butterflies had lived together. Further facts will be given later.

hind wing while skipping the posterior margin of the fore wing so far as this is covered by the hind wing. The same phenomenon is everywhere noticed and is obviously a consequence of the action of light or of lack of light. Selection can create nothing new. It can only work with what is already present. Once the similarity of the wings of a butterfly to a leaf has been produced, it can be useful and further development can then doubtless be favored by selection. The origin of the resemblance, however, cannot be due to accidental variation, which is supposed to have all possible characters ready for selection. *Kallima's* resemblance to a leaf is determined by a thousand and one details. Not one accident but a thousand accidents *together* would have been requisite, and would have had to present themselves suddenly, in order to produce this resemblance by the selectional agency of Darwinism. The resemblance to a leaf could not have gradually arisen by selectional means; it must have originated suddenly and in approximate perfection in order to have given selection any hold for its operations.

There is no chance in the transmutation of forms. There is unconditioned conformity to law only. Definite evolution, orthogenesis, controls this transmutation. It can lead step by step from the simplest and most inconspicuous beginnings to ever more perfect creations, gradually or by leaps; and the cause of this definite evolution is organic growth.

TH. EIMER.

TUEBINGEN.

PROFESSOR F. MAX MUELLER'S THEORY OF THE SELF.

THE PFERDEBUERLA.

AN INTERESTING DISCUSSION of philosophical problems in a popular form appeared lately in the *Deutsche Rundschau* under the strange title of *Das Pferdebürla* by Prof. F. Max Müller. In it the famous Oxford Professor prints a letter from a German-American reader of his in Pennsylvania, who, being a native of Silesia and a farmer plowing his fields with horses, not with oxen, signs himself *Das schlesische Pferdebürla*. The letter of our Pennsylvanian countryman is an exquisite piece of common sense; it is in many respects crude, but shows a healthy disposition of mind and an excellent temper. He has had many troubles to encounter in life, but has never lost his good humor. Considering the transiency of life, he does not mind the buffets of outrageous fortune and is prepared to meet the end joyfully. He finds that the evil in the world is constitutional and indispensable. Thus he hails badness as well as stupidity, for life would be tedious if all people were virtue-machines. As matters are, he says, we enjoy the merry fight and cherish dear ideals in our bosom. He expresses his joy at the liberalism of the Professor, but he doubts whether he is truly free, which he expresses in such sentences as these:

"Max, du bist vielleicht auch noch ein Gottesfabler. Die englische Atmosphäre mag dir zur Entschuldigung dienen! . . . Max, ein ganz Freier bist du immer noch nicht."[1]

[1] There is a special touch of humor in Pferdebürla's employment of the familiar *du* with the great Oxford Professor.

Prof. F. Max Müller is one of the most accomplished controversionalists not only of the present time but of all times; and if he understands anything he understands the art of condescension. He can argue condescendingly with dukes and other personages of high social rank, but it requires a special grace to condescend to the Pferdebürla, and the Professor has succeeded in doing it. He replied to the Pferdebürla's criticism in a long private letter, which, however, remained unanswered up to the publishing date of the June number of the *Deutsche Rundschau*. Did the Pferdebürla die in the meantime, or was the letter not properly addressed? We cannot tell.

The humor which pervades the controversy between the Pferdebürla and the Professor is merely an external feature, the essence of the controversy is quite serious and of a deep interest, philosophical as well as practical. The Pferdebürla sums up his opinion in these words (pp. 204–205):

"Modern life is for every one who has an open mind a real high school. Max all the German scholars, or at least the majority of them, are still under the illusion that man's spirit is a prius. Not at all, Max! Spirit is a development, a phenomenon of evolution. One should think it impossible that a thinking man who has ever observed a child could be of another opinion. Why shall we seek ghosts behind matter. Spirit is a function of living organisms, and a goose and a chicken possess it also. But why, Max, should we not merrily be satisfied with the limits of our cognition, as conditioned by experience, and surrender the infamous fable-making and tyrannical lies? The sole love which I at my fiftieth year still cherish in my bosom is the unsatiable, dear longing for that truth which fate has denied us."

The Pferdebürla is an unschooled but by no means an ignorant man. His education is apparently autodidactic and unsystematic, but he is well read and knows not only such works as Omar Khayyam but also Schopenhauer and Dühring. He appears to contradict himself by first positively declaring that spirit is a development, that it is useless to hunt for ghosts, that we must surrender the invention of fables and lies, and then speaks of his longing for the truth which fate has denied us. If the views he proclaims are not the truth, how can he wind up the confession of his faith with the declaration that truth is not forthcoming? And if there is mys-

tery left, why does he not recognise the fact that there is a reason for inventing fables. His philosophy must be very one-sided for "the truth which fate has denied him," remains after fifty years still his sole love and he cherishes it dearly in his bosom.

PROF. F. MAX MUELLER.

Now, we ask: What has the great Sanskrit scholar to say in reply to the Pferdebürla's criticism? The Professor gives the Pennsylvania farmer all the information he asks for, and sets forth his reasons for still believing in ghosts.

Prof. F. Max Müller's letter to the Pferdebürla is interesting because it is the quintessence of his philosophy and the gist of his religious confession of faith.

Prof. F. Max Müller is a philologist, and his whole method of thought is philological. His philosophical arguments are ultimately based on reflexions upon linguistical relations. He recognises the permanence of universal types such as dogs, men, trees, etc. These types, or Platonic ideas, are the thoughts behind the things, and the great philologist argues: "If there are rational thoughts in nature, there must be also a rational thinker," and this rational thinker must be "in, above, and behind nature."

The same argument is repeated in other forms with reference to natural selection, evolution, and every event that takes place, especially in man's activity of the senses. If there is natural selection, there must be, according to Prof. Max Müller, some one who selects; for there can be no choice without a chooser, and every happening presupposes an agent that causes it. Seeing, hearing, touching, would be impossible if there were not a receiver of sensations.

Prof. F. Max Müller's theory is a very old theory; it is the doctrine of Self as taught in ancient Brahmanism; and he frankly confesses that it is practically the same doctrine as the theory of the ghost-soul. He adds: "Ohne solches Seelengespenst kommen wir nicht aus!"

Prof. F. Max Müller's ghost is not as substantial as the ghosts of spiritualists, but it is just as real. It is not definite, but quite in-

definite, and would thus be very accommodating; but its existence is nevertheless earnestly insisted upon. It is practically nothing but a personification of the unknown quantity, which cannot be found in matter and energy. The Professor says:

"Names do not name him. That is true. Perhaps it had been better to call him *x* or the Unknown One. But if we only know what we mean, why not call him spirit or *spiritus*, i. e., breath. You call him the spook, or *Seelengespenst*. The Brahmans seem to me to have found the best expression, they call him the *Urgrund* of the soul, of the ego, 'Self' and the *Urgrund* of the non-ego of the world-soul, of God, the highest Self. They go further, and regard both these two Selfs as ultimately the same Self."

The theory of self, or, as it is called in Sanskrit, "âtman," dominated the philosophy of India until Buddha came and taught the doctrine of the "anâtman," basing upon the illusoriness of the notion of self his ethics of universal compassion and love. Buddhism flourished for about a thousand years in India, and this period was the age of highest development of Indian art, science, and poetry. Even the ancient productions of Brahmanical literature received their final shape during the Buddhist period of Indian history. After Buddhism was expelled from India, the philosophy of the âtman was systematised by Shankara, and became again predominant in the minds of the Hindus. Modern Hinduism is saturated with the belief in the âtman, and all Hindu religion to-day is practically an âtman philosophy mythologically expressed.

What is the âtman theory weighed in the balance of science?

The assumption of a self within, above, and behind things is simply the reification (or hypostatisation) of the unity that originates by a combination. It is a personification of actions and processes and may thus be considered as mythology taken seriously. A wrong interpretation of language is perhaps at the bottom of the whole mistake. We say "the wind blows," and the metaphysical philosopher would have to regard this process, which is nothing but air in motion, as an action performed by an agent. There is the blowing that takes place and there is the wind, which is the agent that does the blowing. Sensations take place in the eye, thoughts are being thought in the brain. They are, according to

Prof. F. Max Müller, actions of a seer, a hearer, a thinker, who is the self of the man, who is that which is behind his soul, who is his âtman. When we ask ourselves, What is a watch? we come to the conclusion that the watch is not the dial, nor the hands, nor the spring, nor the wheels; but a peculiar combination of all these parts so arranged that the spring carries the hands around on the dial in a regular and definite adjustment to point out the time. According to the âtman theory we ought to say, Here are a number of wheels, a spring, a dial, and hands, none of these parts is the watch. The watch itself is an unknown quantity within, above, and behind the watch, and we call it "the watch in itself" or "the âtman of the watch," or the "watch-self." As to the actions of all these parts we ought to know that not the spring exercises a pressure, but the watch-self in the spring; and not the hands turn round the dial, but the watch-self turns in the hands.

The Buddhist philosopher, Nagasena, has brought out the anâtman theory very clearly in his discussion with King Milinda in the carriage simile. The sage claims that persons are "name and form" and nothing else, not selfs possessing a name and form, and Milinda challenges him on the ground that this theory implies the non-existence of personality. Nagasena asks the king concerning all the parts of the carriage—whether they are the carriage, and when he denies these questions, he concludes (in the same way as the king did concerning the non-existence of personality) that the carriage must be non-existent. This *reductio ad absurdum* proves that the personality of man too is a combination of certain qualities and the assumption that there is a self within, above, and behind the man is redundant. The anâtman theory does not deny either the reality of the carriage or of personalities, it only denies that the unities which originate through combination are selfs, âtmans, or things in themselves.

The philosophy of the Brahmans is (to use a modern term) metaphysicism; Buddhism is anti-metaphysical. The metaphysical philosopher is a philologist who reifies the words which he has coined by abstraction to denote actions or combinations or universal types. Thus reality appears to him as merely phenomenal

and the word by which he denotes this reality, the thought (or *noumenon*) which signifies it, is supposed to be the reality behind the phenomenal appearance. The reality behind the phenomenal is therefore called the noumenal, or thought-existence, and thus while reality is degraded into a mere sham, the mental reflexion of things is supposed to be the sole true reality.

This theory leads to a dualistic world-conception which divides the world into the noumenal and the phenomenal. A monistic view is regained only by a mental annihilation of the phenomenal. The corollaries of this view as characterised by Prof. Max Müller are as follows:

"What do we do with our senses? They seem to be our wings, but if closely analysed they are our fetters, our prison walls."

"We live in a prison, in a den, as was said already by Plato."

"Some philosophers say: Indeed our senses may be limited, but our understanding, and especially our reason, are unlimited; and they recognise nothing that would surpass them (understanding and reason)."

"There is nothing that justifies us in saying that this self has had a beginning and that it will have an end. The ego had a beginning, so has the *persona*, the temporal mask which develops in the present life, but not the self which wears the mask."

"Everything which is called ego, personality, character, etc., has developed upon earth; it is earthly, but not the self.

"What remains is the eternally One (*das ewig Eine*)[1], the eternal self, which without beginning and without end animates all of us.

"The self is the bond which unites all souls, the red thread which runs through all existence, and the recognition of which alone affords us a recognition of our true being.

"'Know thyself' means to us no longer know thy ego, but know what lies beyond the ego, know the self—the self which runs through the whole world, through all hearts, which is the same for all men, the same for the highest and the deepest, the same for creator and creature, the âtman of the Veda, the oldest and truest word for God.

"Fellow-man is fellow-self."

Speaking of evolution, and of his adversaries who advocate the ape-theory of the origin of species, Prof. F. Max Müller says:

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[1] A better translation might be "the eternal onehood."

"They have taught us that the body in which we live was first a simple cell. What the word 'first' in this connexion may mean is another matter which need not concern us here, but this cell was really what the word signifies, the cella of a silent hermit, the self.

"Within this cell there is a shining point (*ein heller Punkt*), and beyond this shining point our microscopes cannot go, although whole worlds may be contained in it.

"If we accept the cell-theory in its ultimate conception, what sense can there be in the late Henry Drummond's proposition (in his *Ascent of Man*, p. 187) that the progenitors of birds and the progenitors of men were at a very remote period one and the same? Would not a little *quantum* of strict logical thought at once cut off the bold hypothesis that we derive our origin directly or indirectly from a menagerie. Every man and also the whole of mankind has passed through its own uninterrupted evolution on its own account. No man, no human cell originates in the womb of an ape or any animal, but only in the womb of a human mother fecundated by a human father. Man does not owe his origin to an abortion."

* * *

Having recapitulated some salient features of the âtman theory which as stated by both Shankara-charya and Prof. F. Max Müller, stand in contradiction to modern science, we ask, "Is the notion of a self a mere illusion, or is there a truth hidden in it?

We believe there is a truth hidden in the idea of a self, for while there are no things in themselves, the organisms and other unities which originate by combination are not nonentities. They are realities. The Brahmanical âtman conception of the self is an inflated value, but the self of a man, his personality, is a very important fact. There is no metaphysical self, but there is a real self, and the error of metaphysicism cannot be overcome by denying the existence of the self but by explaining its true nature.

III. IDEAS, THE ETERNAL TYPES OF THINGS.

Prof. F. Max Müller combines his theory of the self with a Christianised version of Plato's doctrine of ideas as seen in the light of mediæval Realism:

"Behind all things lies the thought or the idea. If there are rational thoughts in nature there must be a rational thinker. Behind all trees, oaks, birches, pines lies the thought, the idea, the form, the word, the logos of a tree. One can never see a tree, one sees only an oak, a birch, a pine, never a tree! But the thought,

or the idea of the tree confronts us in all trees as realised and multiplied. The same is true of all things. No one has ever seen an animal, a man, a dog, but only a St. Bernard, a greyhound, a beagle, and closely considered not even these. What is the constant, the ever returning in dogs, that by which they all resemble one another, the invisible form in which they all are cast? That is the thought, the idea the logos of dog. Now, is there a thought without a thinker?

"Where do we have a tree except in our conception? And what do conceptions consist of, if not of our sensations; and these sensations, imperfect though they are, exist only in us, for us, through us. The perceived object itself is and remains to us outside, transcendent, thing in itself—everything else is our work.'

In another passage the Professor declares, closely following Schopenhauer's[1] argument, against the doctrine of evolution: "Every species represents an act of will, a thought," and he adds, to indicate that every species is rigid, "An diesem Gedanken kann nicht gerüttelt werden, so nahe auch oft die Versuchung liegt."

Prof. F. Max Müller would allow us to doubt all the articles of faith in religion but one. He says: "One fundamental article must remain. There is a thinker and a governor in the world."

This is a strange mixture of Realism, Nominalism, Schopenhauerianism, Platonism, Paleyism, and what not.

In the dictionary we can group words, we can classify them in categories and no one is allowed to take away an iota from a word; but in reality the types of things fluctuate. The baby, the child, the youth, the man, are quite definite types of different ages, and no one can be allowed to mix them up. That is a good rule for a grammar lesson, but in practical life we find them changing from one into the other in spite of Prof. F. Max Müller's protest. The same continuity holds good in the distinction between genus and species. The dog is a species of animal, and the poodle is a species of dog. He who knows something about dogs will be able to enumerate a goodly number of poodle-species. Why we should see the lower species only, as Prof. F. Max Müller declares, and not the genus to which it belongs, is a mystery which I suppose

[1] Schopenhauer was a bitter enemy of the doctrine of evolution and ridiculed Lamarck severely for having propounded it. That was before the days of Darwin.

means that the concrete dog only is seen, but the generalised concept dog is thought and not seen.

The truth is we *do* see a dog in every poodle, as well as in every St. Bernard, in every beagle, and in every greyhound. The type dog is fully and completely in every genuine dog. It is true that the idea dog, as a concept, is our own work; but a general idea is not an addition to the things but an abstraction from our perceptions. It is a mental symbol expressed by a sound which signifies the general features of a number of sensations. The genus dog is not more complex than the species poodle, it is simpler; the higher genus quadruped is still simpler, and the general term animal is the simplest of all. These concepts are not made by additions, but by omissions. The incidental features are dropped and the essential ones retained, but the more general is always contained in the less general; the type is always present in the concrete object from which it has been abstracted. The universal exists in every one of its particular representations.

What is the idea of a tree but a special form of thought, a combination of mental activities of a peculiar kind which represents certain objects of our experience? The idea of a tree is our concept, but is the tree in our conception alone and nowhere else? Certainly not. The concept tree is alone in our conception, but the tree is outside; the tree is that which the concept of a tree has been invented to signify. Ludwig Noiré argues well in favor of the theory that man alone, being a speaking animal, can conceive the idea of a tree; no animal is in possession of ideas. But Noiré would scarcely have denied that for that reason animals can see trees.

That the objects of our sense-perceptions remain outside is true; none will deny that, but they are for that reason not transcendent in the philosophical sense of the word; they do not remain unknown and unknowable. They are not things in themselves in the Kantian sense. The idea of a tree, if it be a correct conception and appropriate representation of the object in question, constitutes our knowledge of the tree. For what is knowledge if not correct representation.

REASON.

Prof. F. Max Müller regards it as obvious that "we can as little go beyond the horizon of our senses as we can jump out of our skin." He makes this statement to prove the limits, not of the senses, but of our understanding and reason. Everybody knows that the senses have limits, but as it is difficult to understand what the limits of reason are, the Professor declares that reason is nothing but addition and subtraction, and, pillorying the exaggerated reverence in which reason is frequently held, he adds: "When people, even philosophers, speak of reason as if it were a jewel "which could be placed in the drawer of the human cranium, they "are myth-mongers and nothing else." Arguing from Locke's famous dictum that there is nothing in our intellect which has not before been in our senses, F. Max Müller concludes that in spite of the extensions of our horizon by addition and subtraction we feel everywhere our limitedness, our ignorance, which, considering the limitedness of our senses (these prison walls in which the self is confined), cannot be otherwise.

Now it is true that our senses are limited, but it is not true that reason is limited.

Reason, by the bye, is not addition and subtraction, but any purely formal operation, especially combining and separating. Addition and subtraction is one particular kind of reason, viz., arithmetical ratiocination, it is a quantitative combination and separation, but there are also qualitative combinations and separations which do not result in sums, but in new products. The composite memory-picture, or concept, of a tree, for instance, is not a mere addition of several sensations in which every single impression remains intact, but a fusion in which the particular features are blurred and that which is common in all of them, the type of a tree becomes prominent and distinct. The concept of a tree is something novel in the domain of sentiency. It is not contained in its several sensations, but is as new as a new-born baby, and

must be regarded as a new person in society. The rise of concepts is not a miracle, but it is the necessary result of a combination.

While I gladly grant that Reason is a very simple operation, —analysed in its simplest functions, it is nothing but a combining and separating,—I cannot approve of Prof. F. Max Müller's derogatory remarks concerning Reason. To be sure Reason is not a jewel that can be locked up in a drawer, but it is much more than a jewel; Reason is not a lamp, lit in the brain; it is much more than a lamp, it is all the intellectual light we have; Reason is not a goddess to be worshipped by the mob (as proposed during the French Revolution); Reason is much more than a goddess. There is no need of showing contempt for anything because it is simple. Reason is the more wonderful the simpler it is, and the feats of Reason are not less important because they are as plain as daylight, obvious in their truth, transparent as glass, and as unlimited as are the operations of counting and measuring.

Reason can indeed go beyond the horizon of our senses and our comprehension can, after all, fly on the wings of Reason into spheres that will remain forever inaccessible to our senses. Does Prof. F. Max Müller not know of the discovery of Neptune, the existence of which was positively known to Leverrier, even before Galle directed his telescope to the place where the planet had been calculated to be? Is that not a going beyond the horizon of our senses?

Prof. F. Max Müller has frequently uttered disparaging remarks concerning the reverence people show for Reason, but he himself assumes always a worshipful attitude when speaking of the Logos. What difference is there between Logos and Reason, except that the former is Greek, the latter Latin? The former slipped into the New Testament, the latter into the terminology of philosophy and of common speech; the former has thus become a theological expression, the latter the party cry of Liberals. Shall we denounce Reason as ungodly and sing hymns to the divine Logos? Let us be fair and recognise the truth wherever it is, and let us boldly acknowledge that the Logos that was in the beginning, the Logos that is eternal and omnipresent, is simply combination and

separation; or, as Prof. F. Max Müller would have it, addition and subtraction. But if the Logos is so simple, let us beware lest we have a contempt for it. Its simplicity does not make it less divine, but is only one more reason to glory in its divinity.

FORMS IN THEMSELVES, NOT THINGS IN THEMSELVES.

Kant was a great philosopher, but his idea of the unknowableness of things in themselves is, after all, a great error, based upon the argument that purely formal thought, being *a priori*, is purely ideal. Kant's misconception originates by unconsciously identifying the terms "ideal" with "subjective." Every thinking being can construct in his own mind the mathematical laws that govern the motions of stars; hence Kant concludes that the mind dictates these purely subjective laws to the objective world; it is so constructed that it cannot help contemplating the world as being in time and space and as being subject to the categories of Reason, especially the necessary connexion of events, called causation. If form were a mode of thinking only and not a quality of the objective world, then of course, the objective world would be unknowable and we could never know what things are in themselves. But if formal thought is only one special case of form that finds its analogies everywhere in the world; if the congruence of the laws of purely formal thought with the purely formal laws of nature, is the result of a sameness of operation in two different spheres, then the things are knowable and there is no cause for despairing of reason and its applicability to nature.

The conception of things in themselves is a materialistic conception of the problem; the very term is misleading. That which constitutes the suchness of a thing, its peculiar character is its form and nothing thingish, nothing that has anything to do with matter or substance of any kind. Therefore the thing in itself, the self of the thing can, properly conceived, mean only the form of the thing; and the form of the thing is its type, its logos, its noumenon, and here we agree with Prof. F. Max Müller's recognition of the eternity of all the logoi. The forms of things exist not only

in and with the things in which they are actualised, but are eternal types; they constitute a superreal reality, a supercosmic order of things, a supernatural nature of existence; they are the absolute that governs all relations, the uncreated that shapes all things, the unconditioned that conditions every event, every action, every being.

The forms of existence are not single entities; they are not separate, so that one can not change into another. They constitute one continuous system and admit very well of evolution from lower simple types to higher and ever higher types. Nor can we say that the eternal logoi, or ideas are products; they are not as Prof. F. Max Müller claims, *Machwerk* manufactured by a *Macher*, a manufacturer. They are not creatures, they are uncreated. They are not made by God, they are God themselves. The ancient Christian dogmatists denied that the logos is a manufacture; to them the logos was uncreated, but (as they expressed it) was the only begotten son born of the Father from eternity and equal to Him in divinity.

The world of forms is not chaotic, but definite and determined. We can imagine all kinds of forms, but those forms which are possible are limited according to law. The first instance of the determinedness of form is found in the chemical elements which are very limited in number. The chances of divergency increase in the spreading branches and higher complications of the tree of life, but they too are limited in their possibilities to definite types, and the laws of life are rigid according to the law of causation. In the highest sphere of life when reason appears incarnated in speech, we are again confronted with definite laws of rational action, resulting finally in a clear conception of life and its aims which will naturally find expression in moral endeavor. Whatever things or beings originate, they are always mere realisations of the eternal order of the universe. All creation is, in this sense, an actualisation of possible types. Every invention is (as the word indicates) a finding out of a form which existed from all eternity as a possible combination, viz., as a form itself, only that it had not as yet been known.

The watch, the steam engine, the dynamo, are forms of existence which as pure forms are eternal types that must be discovered if they are to be actualised in concrete existence; and in this sense they are indeed as Prof. F. Max Müller says, within the things, behind them, and above them. The difference between Prof. F. Max Müller's view of things in themselves, and this view of forms in themselves, is simply this, that the former is tinged with metaphysicism and mysticism, while the latter is both antimetaphysical and antimystical.

THE SELF OF MAN.

Having seen that the selves of things are not metaphysical essences or entities, but consist in the forms that constitute their type and condition their suchness, we are naturally led to the conclusion that man's self also is the form of his being; and there is nothing that can be adduced to contradict this proposition.

Personality, says the Buddhist philosopher, is name and form; and the continuity of life, according to the maturest results of physiology and psychology, is conditioned by a preservation of form. The continuity of a man's personality is based upon his memory and memory is the psychical aspect of a preservation of cerebral structures. Hence we can justly say that every man is a certain form realised in a bodily incarnation. The material of which this form is composed is constantly replaced by new material, and indispensable though it be for bodily appearance, it is yet of merely incidental significance. In other words, we are not what we eat, but we are the form into which the food we eat is moulded.

Man's personality is based upon a preservation of form. The form of our organs of sense, our brain-structures, our life-memories is that which continues while the matter and the energy which we use pass through the system of our body in a constant and rapid transit. We may say that matter assumes a certain shape, but it is more correct to say that a certain shape assimilates a certain amount of matter. At any rate, a man is as little the matter of which his body consists, as ideas are the ink in which the words that express them are written. Nor is man the breath (or *Hauch*)

which passes through his lungs. Not even the feelings *qua* feelings can be said to be the properly human of man. Every animal, even every amœba is sentient, it is possessed of feeling. Human sentiments are definite forms of feeling.

Everywhere form is the essential feature that makes a thing what it is, and even sentiency such as it obtains in living creatures as a characteristic feature of animal-life must be due to a definite form of organisation.

The doctrine of self is, to Prof. F. Max Müller, the cornerstone of all religion and the essence of all philosophy, but when he enters the field of ethics the tables are turned, and the self is dismissed. He says:

"At any rate, we agree that everything that is done from love of God and our neighbor is good; everything that is done from a seeking of self is bad."

Prof. F. Max Müller's theory of self serves him only as a philosophical comfort for the lovers of self, but finds no application in ethics.

Self-seeking is wrong, as we all agree,—except such philosophers as Nietsche and Steiner; and yet in a certain sense self-seeking is not wrong. Indeed, the preservation of self and its further evolution to higher stages is a duty. Professor F. Max Müller's self, being the same forever and aye, cannot grow, but the real self (that which, according to Professor F. Max Müller, is only the phenomenal self), the totality of soul-forms of man, can by new insight acquire new features; it can degenerate, but it can also improve and be added to. And in this sense ethics is a seeking of self; it is self-culture, but all self-culture is simply the realisation of the eternal pattern of perfection.

The type of a rational being is an eternal form of existence which can be realised in life. That which constitutes the humanity of man is *not* a feature which descended upon him from brute ancestors. The ape lacks rationality, and in this sense I can frankly agree with Prof. F. Max Müller in his objections to certain one-sided assertions of naturalists. That something which begot the humanity of man is the eternal Reason, the Logos, the Rationality

that was developed in his soul when he began to systematise his experiences. Man's begetter, in this sense, is not his brute progenitor, but the eternal order of the universe, which naturally and appropriately, and indeed justly and most beautifully, is symbolised under the allegory of a divine Father.

* * *

We have touched upon the salient features of the problem of self, and have only to indicate in conclusion that all the religious and moral aspirations of man receive in this solution, as offered by the Philosophy of Form, a more exact and scientific explanation. The immortality of the soul appears in a new light, the idea of God is purified of paganism and mythology;[1] and the moral code, especially the apparently anti-natural ideal of universal good will—including the love of enemies—is found to be rooted in the eternal conditions of existence.

POSTSCRIPT.

It is not a habit of mine to write postscripts, but I have a remark to make which does not properly belong to the subject matter of this article.

Prof. F. Max Müller expresses a desire to know "what the origin may be of the old proverb, 'much cry and little wool,' which is heard so frequently in England." He continues: "At last I dis-"covered that there is a second line to it, viz., 'As the Devil said "when he shore the sow,' for there was in that operation much cry "and little wool on the part of the sow, but only bristles." In reply to Prof. F. Max Müller's question I have to say: The proverb is originally German, "*Viel Geschrei und wenig Wolle*," and the word *Geschrei* stands for *Geschererei*, or shearing. There are a great number of similar Low-German sayings which have by a change of dialect ceased to be understood in their original form and are now current in a perverted version. As analogous cases that fall in the same category and may be of interest, are the proverbs, "*Zu nacht-*

[1] The problem of the idea of God is treated in the current number of *The Open Court*, October, 1897.

schlafender Zeit," which means literally "at night sleeping time," while the original form *nachtschlafende tiet*, means "night sleeping people," the word *tiet* being the same word as *Diet*—people, from which *dietisch* or *deutsch*, i. e., "the people's language," has been derived. Another similar perversion is found in the proverb "*sein Schäfchen ins Trockene bringen*," literally to "bring one's little sheep into the dry," i. e., to shore, but the Low-German form, *Schepken*, means "little ship." Finally, we may mention the German chess term, *Läufer*, for bishop, which means literally "runner," but is a perversion from *Lepel*, spoon. The Saxon peasants called the bishops "spoons" because they were commonly carved, like spoons, in imitation of a bishop's mitre.

EDITOR.

LITERARY CORRESPONDENCE.

FRANCE.

LIKE all the works of M. RIBOT, his *L'Evolution des idées générales*[1] is distinguished by unusual clearness and simplicity. We may state its purpose and conclusions in a few lines, as in fact M. Ribot himself has done.

The principal aim of his work, he tells us, is to follow the progress of the mind when it abstracts and generalises, to show that these two operations already exist in perception and progressively attain, by stages which we can define, the highest forms, the pure symbolism which is accessible to a few only. He states in concluding that "the object of thought by concepts is to substitute for complex states simplified states," signs which are easily manipulated but which contain a store of real though latent knowledge; and that "the psychology of abstraction and generalisation is thus in great measure a *psychology of the unconscious.*"

M. Ribot then proceeds to follow, step by step, the degrees of abstraction; he exhibits the evolution of this process of the mind and indicates here three grand stages: that of *generic images* (the *recepts* of Romanes which the latter ranks between the simple percept and the concept); that of *intermediate abstracts;* and that of *higher concepts.* In the lower forms of abstraction (among animals, children, and uneducated deaf mutes) the word cuts no figure, does not exist in fact, the mind is still occupied with the concrete. In the intermediate forms the word begins to play a rôle. In the

[1] F. Alcan, publisher.

higher forms, finally, it passes to the loftiest plane. It is even characteristic of the concept not to be "representable," which of course does not mean that it has not its root in representation.

Association and dissociation are the two types of intellectual activity. The act of abstraction belongs to the second type, being in its negative aspect the elimination of objects and in its positive aspect their psychical reinforcement. The natural mechanism, writes M. Ribot, by which the separation between the strengthened elements and the weakened elements in perception is effected, is a rough primitive sketch of what will later be abstraction. The same forces are in play and are reducible ultimately to the imparting of a particular direction to the attention. On the other hand experience remains the groundwork of our concepts. General terms cover a latent organised knowledge constituting the hidden capital without which we should be in a state of bankruptcy, manipulating counterfeit money or valueless paper. "General ideas are habits in the intellectual order." In sum, the useful work is performed beneath consciousness. Nothing is noticeable but results, indications, or marks.

It would be a supererogatory task to enumerate the interesting and profound *aperçus* which these pages contain on many questions of psychology, on language, gestures, counting, and zoölogical classifications, the history of which, M. Ribot ingeniously remarks, proceeds hand in hand with the evolution of generic ideas. I will not repeat here the psychological analyses of his work but restrict myself to indicating its philosophical scope.

The results of these researches are evidently unfavorable to the doctrines that are more or less vaguely classed as spiritualism, idealism, contingence, etc. Besides, M. Ribot carefully avoids all controversies which would lead him away from his subject, in which he has completely sunk himself. There is nothing more instructive, furthermore, from this point of view than the special study which he gives us in the second part of his book of the concepts of number, space, time, cause, law, and species. He shows us, for example, that "space is infinite only in potency, which potency is in us and in us only"; that "the voyage to the end of space of

which John Stuart Mill speaks is tantamount to a voyage to the end of mind"; that "space conceived as infinite is reducible to the power which the human mind possesses of constructing series, thanks to the abstraction which enables it to grasp the law of their formation." He asserts that "consciousness is the necessary condition of any conception whatsoever of time, which appears and disappears with it." Finally and particularly, he attributes to the notion of cause its purely scientific signification. "The antecedent is not one thing and the consequent another thing: they are two manifestations, differing in time, of a single fundamental identity." The facts of thermodynamics offer the best example of this conception. There remains, it is true, another meaning for the notion of cause. Some conceive it not as an invariable relation of antecedent and consequent, but as a thing which acts, creates, is modified or persists amid all transformations and assumes all manner of masks. Now cause, thus understood, if it is to remain intelligible, "can," M. Ribot reminds us, "only be imagined or represented under the form of muscular effort, which is its origin and remains its type." It remains a fact of internal experience rather than a concept and the secret of the future will be to ascertain if there is room by the side of mechanical causality for any other form of causality.

To explain as much as possible by actual practical experience and by evolution, is the method from which M. Ribot never swerves. Let us follow it as long as it yields us results. It is an old weapon, say some of our young philosophers who hanker after metaphysics; but it at least never fails to bring down its game.

* * *

In M. TARDE'S *L'Opposition universelle, essai d'une théorie des contraires*[1] we have not only a work which is utterly different from that of M. Ribot, but we have in its author an utterly different type of mind. M. Ribot is clear, simple, sparing of words and effects. M. Tarde is complicated, and at times difficult. He has enthusiasm, brilliancy, and great reserve power. Particularly is this true

[1] F. Alcan, publisher.

of his present instructive work in which the question of contradictions is treated with originality though without giving the reader of its four hundred pages the impression that it has been exhaustively handled.

M. Tarde defines *opposition* as follows: "when two variable terms are such that one cannot be conceived as becoming the other unless it traverse a series of variations that end in a state zero and then ascend again that same series of variations through which it previously descended,—then those two terms are opposed." These terms may belong, further, to different orders of facts. It will be necessary, therefore, to distinguish qualitative and quantitative oppositions, and among the latter dynamic oppositions: some being objective or mechanical in character and reducible to the type of two movements in contrary directions along the same straight line; others being subjective in character and reducible to two kinds, the force of denying as opposed to the force of affirming, and the force of refusing as opposed to the force of desiring.

Two things, whether they coexist or succeed each other, cannot be absolutely the same, if not in matter at least not in space and in time. Among all the possible situations in which they meet, they oppose each other. Opposition thus appears as a particular case of universal existence: a case with a hundred different aspects, inasmuch as it comes to pass for almost all existence (contrarieties of motion, direction, velocity, resistance, energy, desire, etc., etc.). But the contrarieties specially strike us when they are concerned with the actions of living beings, for then the *variations* which they provoke have an unusual importance for our practical life, and affect our sensibility as well as our reason.

The different forms of social opposition (war, for instance,) have long since claimed the attention of M. Tarde. He has directed his researches towards the understanding of these forms in view of their possible attenuation. He establishes, doubtless, the gradual transformation, in societies, of relations of adaptation into relations of opposition, or *vice versa*. But he is constantly bent on making fecund harmony prevail over destructive work, and re-

ligions have no value in his eyes except in so far as they contribute to this result.

Should we not recognise "at least the transitory utility of certain imaginary or ultra-terrestrial objects of desire and faith for reconciling terrestrial desires and ideals? Are they reconcilable at no other price?" This, for M. Tarde, is the great problem. The optimistic solution of Guyau, the "*laisser-faire* ethics," do not inspire him with confidence. As to the possible harmony of fundamental truths he also remains quite sceptical. Reflecting on how man works, enjoys, or suffers in the pursuit of his dreams, he even risks the following disheartening question: "The pursuit of the impossible through the agency of the useless: can that be the last word of existence?" But these *useless* things serve a purpose if they keep up the desire and the illusion of the *impossible!*

It is a very curious work in fine, full of insights, and exacting on the reader's powers of thought. The new questions always lead back to the old problems.

* * *

M. STRADA has not let us wait for the book which he announced, *La religion de la science et de l'esprit pur, constitution scientifique de la religion.*" He had already traced its general outlines and enunciated its fundamental thought. For M. Strada, as our readers know, *method* explains history, and history is divided from this point of view into three epochs of which each carries the mark of a dominating criterion: faith (fideism), personal evidence (rationalism), and finally the fact (impersonalism, which the author proclaims). Now, if we consider religious events from the same point of view we shall see that the so-called positive or revealed religions correspond to the fideistic period because they transfer the criterion to mediators who have been deified (Buddha, Jesus, Mohammed, etc.); the so-called natural religions correspond to the rationalistic and critical period, because they attribute the criterion to a man, a scholar, the founder of a school; but that the religion of science can exist only by the impersonal method, be-

[1] F. Alcan, publisher

cause then the Fact alone, the objective, indestructible Fact, becomes the sole foundation of certitude and constitutes at once science and religion.

I have pointed out already the analogy of this conception with the law of Comte (the law of the three stages,—theological, metaphysical, and positive) and shall not revert to it. How does M. Strada conceive the relation of religion and science? Clearly enough, in the same manner that I have presented it here, and without any great novelty. Religion, he writes, is the emotion of science. It is always and everywhere proportional to it. "When "I say the emotion of science I say simply the emotion, the senti- "ment, the felt consciousness of science so far as ascertained. . . . "This profound sentiment must arise in the face of science, since "it is born of the vague apperception of its hypotheses. Religion, "therefore, belongs to all epochs of humanity. It follows the state "of science, for it is naught but the emotion which springs from "the state of knowing. . . ."

Let us observe here that according to M. Strada man started with monotheism; polytheism, being the result of analysis, must have come later. "Monotheism," he writes, "is the first conception of religions by virtue of its inherent sentiment of an unknown fatal force which is always and everywhere present and affirmed." One might object to this point that the vague sentiment of force is one thing, and the affirmation of a single, absolute God another. It appears to conform more to a sound psychology and to observation, that man should first have incarnated "power" in the things which strike him, in the natural phenomena which menace him, and that he should have come only by degrees to the abstraction of force.

But let us quit this dispute. What is God, according to M. Strada, and how do we perceive him? It is the Fact, he says, which reveals God to us; the Fact is the realisation of the idea of God, and it is hence the idea of God which man thinks in thinking the Fact. "If the dead painter has put his idea into a painting, if the father in dying puts his idea into the letter which he writes to his son, the spectator, the son, in seeing these facts—the paint-

ing, the letter—lives in the thought of the painter and the father, though he will never again see the painter or the father! This is how the mediating fact establishes the relation between God and man. Simple-minded people feel this in life without reasoning. Thus they efface themselves with humility before the unknown, incommunicable God, from whom they experience a mysterious, secret communication of power."

God, says M. Strada further, is the absolute, preantinomic or affirmation of which our logic stands in need—pure spirit which it is no longer necessary to separate from the world, which it is not necessary to suppose coeternal with matter. The author will revert to these questions. But always and everywhere science is the mother of true religion and religion itself, because it alone makes us know God and live in God.

I shall pass by the details of this work—a solid production containing many beautiful passages, although full of fatiguing repetitions. M. Strada has certainly convictions. He never doubts that he has given to the world the truth which will save it, that he is the Bacon and the Descartes of future times, and he honestly believes that his *methodical impersonalism* is a novel procedure which scientists have never heretofore followed! Yet what does the scientist do who constantly begins anew his experiences and resumes unceasingly his labor, if not to patiently interrogate the *Fact*, to submit and declare it the sole master, the last guide, and the expression of the laws of the universe? M. Strada has the merit which I gladly accord to him of precisely formulating the situation; he will not have lived without exercising an influence nor without having left behind him some trace.

* * *

I recommend a good work by M. ANDRÉ CRESSON, *Sur La Morale de Kant*—a study in which M. Cresson shows clearly both the logical defects in the moral system of Kant and the falsity of his principles, and ends with the conclusion that this philosopher of genius, by the very originality of his attempt "has done nothing but prove more clearly than ever the impossibility of discovering

an ethics which is not founded on the rational science of human nature or on a religious metaphysics."

I also recommend a work by M. L. DAURIAC, *La Psychologie dans l'opéra français* (*Auber, Rossini, Meyerbeer*)—a study not in musical criticism, as M. Dauriac tells us, but of musical psychology, wherein, however, he abides by the ordinary methods of criticism and seems to me to insist a little too much upon grounds of sentiment.

To be mentioned finally are, a new edition of M. V. BROCHARD's *De l'erreur; Nature et moralité* by M. CHARLES CHABOT; *La modalité du jugement*[1] by M. LÉON BRUNSCHWICG—a study on the value of our theoretical and practical judgments, the whole of which constitutes on the one hand the work of perception and the edifice of science, and on the other the development of the individual will and progress of the moral life. And particularly is to be noted a special edition of the *Sociology* of Auguste Comte which has been epitomised by M. RIGOLAGE (JULES RIG); a publishing enterprise which has its significance, and which will not remain unnoticed.

LUCIEN ARRÉAT.

PARIS.

[1] All these works are published by F. Alcan.

CRITICISMS AND DISCUSSIONS.

AUTOMATISM, DETERMINISM, AND FREEDOM.

Mr. Arthur Harington's courteous criticism of my discussion of automatism shows that I have failed to make my position clear. Regarding, apparently, the term "automatism" as synonymous with "determinism" in the sphere of animal life, and disregarding the fact that I was contending for a more restricted usage, he endeavors to place me on the horns of a dilemma. "Either then," he says, "Prof. Lloyd Morgan must give up his present belief that 'the organism yields to the strongest prompting' or his conclusion that actions, whether of animals or men, cease to be automatic, that is, mechanical and 'determined,' when they are the result of 'conscious selection and choice'." But since for me "automatic" is *not* coterminous with "determined" I am not prepared to plead guilty to the charge of inconsistency implied in the sentence just quoted.

Let me try to make my exact position as clear and free from all ambiguity as a very condensed statement allows.

Many organic activities are such that, quite apart from any experiance, a given stimulus, or group of stimuli, gives rise to a more or less definite and stereotyped response. Such response is automatic in the sense in which I use the term. But there are other activities which, though none the less determinate, are not automatic. Intelligent behavior, based upon the data afforded by previous experience, is not automatic. In such intelligent behavior cerebral centres or their equivalents (let us call them control-centres) are called into play by which response is either augmented or inhibited. But in contending that behavior in so far as it is modified by the functional activities of these control-centres ceases to be automatic, I am far from contending that it ceases to be determinate. The action of the control-centres I believe to be neither more nor less determinate than the action of the automatic centres. Their activity is the determinate outcome of the physiological impulses by which they are called into play. In this sense, as Dr. Waller contends in the passage which Mr. Harington quotes, their activity may be said to be of the same fundamental nature as reflex action. I do indeed question the wisdom of applying the term "reflex action" to voluntary and intelligent behavior—but that is another matter. In any case I should say that the action of the control centres though determinate is not automatic.

Now, if determinism and automatism as applied to animal activities, are synonymous, the latter term is redundant and may be abandoned. But it is more than redundant; it is confusing. To say that a man who receives a letter offering him a certain position, and who, after careful consideration telegraphs his acceptance—

to say that such a man acts automatically does not appear to be a satisfactory use of the term, when we already have "determinate" to express the belief that in his decision he yields to the strongest motive.

My suggested terminology (omitting the secondary automatism of habit) may now be summed up in the following scheme:

Reflex action.	Instinctive activity.	Intelligent behavior.	Rational conduct.
	Automatic	Voluntary	Volitional
		Determinate.	

A word or two may be added concerning "freedom." Mr. Harington regards any reconciliation between freedom and determinism as "hollow and unreal.' Here again everything depends on the meaning we attach to our terms. If "free" is antithetical to "determinate" of course no "reconciliation" is possible. In any given case we must either have freedom or determinism; we cannot have both any more than a glass can be both full and empty at the same time. But if we use—as I contend that we should use—"freedom" in antithesis to "external constraint," both have their place in a scheme of determinism. That which is intrinsically determinate is free; that which is extrinsically determinate is under external constraint. Otherwise stated, freedom is immanent; not-freedom is due to the influence of environing forces. The notion that the activities of nature are externally caused is part of the metaphysics of special creation; and the idea that determinism is synonymous with external constraint is a legacy of that metaphysics. Given an organism as a self-constrained mechanical system. If we regard this system as a whole we may say that under the influence of a stimulus or group of stimuli it responds in a certain determinate fashion. When it is not let nor hindered from effecting the response it is free; if in any way or in any degree its free response be interfered with it is not free, but under external constraint. But if we regard the higher animal as comprising (1) an automatic system and (2) a controlling system, then the automatic system, in so far as its action is augmented or inhibited by the control-centres, is under constraint. Its free action is interfered with and the controlling system, in so far as its inherent activity is interfered with by external influence, is under constraint. When it is not thus interfered with it is free to exercise its inherent power of determinate control. The man in the street who claims freedom to act as he chooses in response to the strongest prompting, puts forward a claim for his cerebral centres which in my judgment cannot be gainsaid. And if some one objects that his acts are after all determinate, he may well reply: Assuredly they are; but just in so far as they are determined by the intrinsic activity of some precious ounces of grey cerebral matter, their freedom is immanent in the system of my brain and its concomitant consciousness.

Again summarising in schematic form we have:

Intrinsic activity	Activity enforced by the environment
Free	Constrained
Determinate.	

C. LLOYD MORGAN.

BRISTOL, ENG.

BOOK REVIEWS.

KARL ERNST VON BAER UND SEINE WELTANSCHAUUNG. Von *Dr. Remigius Stölzle*, Professor der Philosophie an der Universität Würzburg. Regensburg: Nationale Verlagsanstalt. 1897. Pages, 687. Price, M. 9.

Karl Ernst von Baer was born in Esthonia, on the 17th of February, 1792, of an old German family which had emigrated from the Fatherland to Russia in the middle of the sixteenth century. His instruction prior to his fifteenth year was confided mainly to private tutors; afterwards it was continued at the academy in Reval, and at the Universities of Dorpat, Vienna, Würzburg, and Berlin. In 1814 he became doctor of medicine at Dorpat, but being dissatisfied with the facilities offered there, he proceeded to Vienna, Würzburg, and Berlin, where his studies gradually tended away from medicine to natural history and biology. It was at Würzburg that he enjoyed the opportunity of studying under Döllinger, who lectured on comparative anatomy, and of intercourse with the philosophical botanist Nees von Esenbeck, who found little difficulty in winning the interest of the gifted young scientist for the fascinating speculations of the *Naturphilosophie*, then captivating the best intellects of Germany. In 1817 he accepted the position of prosector at the university of Königsberg, where he remained seventeen years unfolding and publishing his greatest discoveries. His researches, consonantly with the universal character of his mind, covered an enormous field, and embraced animal and human anatomy, zoölogy and anthropology, paleontology, and much work in practical social fields. It was here that he developed his main ideas of scientific embryology of which he is regarded the founder,—notably his doctrine of types of organisation (a development and verification of Cuvier's work), his discovery of the ovarian ovum of mammals which definitively settled the old controversy between evolution and epigenesis, at least in its old conception, his discovery that the embryos of the higher vertebrates repeat in development the embryonic forms of their lower predecessors, the significance of which was made clear by Darwin's researches, and was afterwards extended into Haeckel's fundamental biogenetic law, etc. In 1834 he accepted a call to St. Petersburg, where, despite his dislike of his surroundings, he developed an enormous activity. His geographical and ethnographical researches were alone sufficient to have made a scientific reputation.

Besides this, he continued his old work, made extensive scientific journeys into remote parts of Russia, and wrote books of travel. His participation in the practical, actual work of life was also extremely varied during his St. Petersburg sojourn, and marks a characteristic side of the man's life. He combated with might and main the seclusiveness of German professors, and contrasted their shyness to appearing in public life and participating in public instruction, to the contrary state of affairs in England and France. On all practical questions and enterprises his advice was sought and given with a wealth of knowledge probably second only to that of Humboldt in his age. He spent the last years of his long life in Dorpat, engaged to the end in unremitting and fruitful labors. He died there in 1876, leaving behind him a legacy to humanity which few men can equal. At the celebration of the sixtieth anniversary of his doctorate he modestly says in words which remind us of Helmholtz's utterances on a similar occasion: "I have discovered much, and my success has been great. But when I think of the manner in which I have accomplished it all, I can only say that it was through a fortunate combination of circumstances, and through the favorable shaping of my life."

This attributing of success to destiny in life, which marks the utterances of so many great discoverers, is in Baer's case especially characteristic. He had in him, we may say, a tendency to fatalism which explains much of his philosophical bias. For example, his position in St. Petersburg having from its inappropriate environment been uncongenial to him, he remarks that he had never in his life accomplished anything by his own free will and by his own initiative; all that he had achieved had been thrown in his way by chance. It was chance that had drawn him away from medicine to science, chance that he became prosector in Königsberg, chance that by his friend and colleague's disappearance from the field he had become a full professor and so been put in a position to make his discoveries. As our author, Professor Stölzle, says, "He does not refer the happenings of his life to Divine Providence, nor to his own independent action, but to fate," exemplifying Schelling's saying that "nearly all great men of action or thought have been at bottom fatalists."

At a time when science, from horror at the extravagance of the reigning philosophical systems, utterly repudiated all alliance with metaphysics, Baer, who had his roots in the philosophical heyday of German thought, was a philosopher with his mind constantly bent upon the universal and monistic trend of existence. He distinctly held the position, which is now a popular one with thinkers, that philosophy should be reared upon the solid foundation of special research. He was thoroughly conscious of the necessity of a systematic and unitary view of nature. He saw that there was a deep inward connexion to all things, and thus, despite its extravagant nonsense, apprehended the kernel of truth at the basis of the *Naturphilosophie*. The aim which it endeavored to realise was in his mind a legitimate aim, though the methods which it adopted were false and ridiculous; and so, while rejecting it, he gained much of value from it. He considered all sides of the phi-

losophical problem, but he was particularly engaged with the history of teleology which formed the backbone of his philosophical thought. And on this cardinal doctrine, which is of the utmost importance in philosophy and science, we must dwell at some length.

The attitude of thinkers in Baer's day towards this fundamental question was, as he conceived it, either one of slavish adherence to a totally anthropomorphic teleology or of absolute repudiation of any purpose whatever in nature. Baer repudiates the first conception no less than the second. Wherever he looks he sees finality in the world, and would hence eliminate all obscurity from the question by proposing a new terminology. He believes that most of the attacks on teleology have their ground in improperly defined terms. He objects to the use of the word "purpose" (*Zweck*), maintaining that it has an anthropomorphic connotation, that it involves the notion of voluntary conscious action and is so absolutely inapplicable to nature. We cannot say of the processes of nature, he contends, that they have a purpose. It is not the purpose of the chicken-egg to become a chicken, because there is neither consciousness nor will in the egg, nor is it the purpose of the lungs to carry off the carbon in the blood and to introduce oxygen therein, etc. Where there is no will, there can be no purpose. Baer is driven, accordingly, to seek some other word for the expression *Zweckmässigkeit* (adaptation to purposes) then in use, and after attempting the words *Zielkeit*, *Zielmässigkeit*, *zielmässig*, he ultimately hits upon the terms *Ziel*, *Zielstrebigkeit*, *zielstrebig*, as utterly bereft of anthropomorphic connotation and as expressing the exact gist of the question. These words, which are now so common in German philosophical and scientific literature, were then quite new in the German language and were formed upon the analogy of the older terms *Zweck*, *zweckmässig* and *Zweckmässigkeit*. *Ziel* means "end, goal, or aim"; *Zielstrebigkeit* means "tendency to aims or ends," it is finality of movement or development, and by Baer's own conception of it is perhaps best explained by identifying it with the *entelechy* of Aristotle, or the principle that things bear within them the end and aim of their development. Baer reached in fact by independent reflexion and observation on the developmental history of animals the very same results at which Aristotle arrived. "The goal or aim here indicated," he says, "is the termination of the movement considered, and does not exclude in the slightest the necessity or compulsion involved; it is, in fact, by very virtue of that necessity, all the more thoroughly secured. . . . An arrow shot from a bow, assuming that all the conditions involved have been accurately determined, proceeds with absolute necessity towards its goal without any inkling of purpose." Any event of which the result is previously determined, is, according to Baer, *zielstrebig*, that is, has a tendency to a definite end.

The doctrine of finality in nature, or of adaptation to definite manifest ends, runs like a red thread through all of Baer's investigations. It finds its particular application, however, as opposed to the teleophobia of the Darwinists. Darwinism had been held in Germany as giving the final quietus to the reign of teleology in

animate nature, and such great inquirers as Helmholtz, Sachs, and Dubois-Reymond were all agreed that the supposed finality of the organic world was not the result of conscious purpose but of necessity. To this Baer objected: "If you assume necessities without aims, your necessities are unconnected with one another, and their results can only be accidents." This leads him to a discussion of the nature of accident or chance. The striking of the bull's eye of a target by a stone which has been struck by the hoof of a passing horse is not chance, but the necessary mechanical consequence of the stroke of the horse's hoof. But it was chance that the stone, of which the target was *not* the aim, did just happen to strike the bull's eye of that target. Chance, therefore, exists, and Baer concludes: "The person who tries to explain adaptation by necessity alone, without tendency to ends, accepts chance, that is, something absurd, as his explanatory principle.' Chance heaped on chance a billion-fold is necessary to have produced the animate world by Darwin's theory; and that, surely, is impossible. His whole objection, in fact, resolves itself into the contention that necessity implies finality and that finality can be attained only by necessity. Necessity without finality is a contradiction and irrational.

Baer's criticism of Darwinism has perhaps not yet been appreciated, and it is doubtless true that many of the Post-Darwinian controversies which have grown out of the lacunæ in Darwin's system, were correctly foreshadowed by Baer. It could hardly be expected that a man of Baer's power and age, and with his great achievements in embryology and the theory of descent, could have taken the fresh and plastic attitude towards Darwin's views which the younger investigators of his own age took. We have only to remember here the attitude of Huygens with regard to Newton's theory of gravitation, and also the inability of Euler to grasp in its full scope Lagrange's conception of variations, although Euler had laid through many years of research the very foundations of this department of mathematics. Baer's criticisms may carry weight, but they may also have their explanation. Neither Darwin nor Baer is the less great for either having been opposed in opinion to the other. It suits with the purpose of the author of this work to reject Darwinism and in fact all theories of evolution that militate against the orthodox Christian view. It is explainable, therefore, that he adopts eagerly the utterances of some minor German naturalists who have recently pooh-poohed the theory of Darwin as something antiquated and definitively refuted. Our age bears in every department of research the signature of Darwin's thought, and it is not for pygmy epigones to belittle his significance. Truly, as Goethe saith in a profoundly ethical verse:

> "Ein jeder Wallfisch hat seine Laus,
> Kann auch die seine haben."

Weismann has recently referred to these very utterances, and pricked the bubble of their pretentiousness.

It is beyond our limits to touch on Baer's valuable and revolutionary ideas in

biology and anthropology. The author of the present work has devoted the best part of this volume to the discussion of their philosophical upshot. He also has much to say upon Baer's ethical, pedagogical, and political views, and upon his philosophy of history. It remains for us to mention briefly his religious opinions

Baer was a deeply religious and ethical personality. His teleology and wide knowledge of nature inevitably led him to a pantheistic conception which in his later years, it would seem, verged on theism. In the eighty-fourth year of his life, a few weeks before his death, he read a work by J. H. Fichte which, according to Professor Stölzle, converted him entirely to the belief in a personal God, which formerly he had expressly and strenuously denied. The grounds for the author's conclusion are, to say the least, weak. Baer was eighty-four years of age and dying when he was visited by a pastor to whom he said: "I have read Fichte's book and now believe what I have never believed before, that a monistic view of the world is not fully satisfied by the pantheistic conception." Later, on his deathbed, having asked the same pastor whether Fichte's book had interested the latter, who replied: "Yes, because it espouses the cause of the personal and living God," he answered: "Yes, the cause of the personal and living God who has predetermined all things." These were almost his last words. But they are not sufficient to make out a case of deathbed-conversion, for the evidence can be variously explained. To the author who has written this book for a definite purpose, they can be explained only in one way.

Professor Stölzle's volume is a portly one and shows painstaking research. It might have been less portly in our opinion and have contained fewer repetitions but it gives much of Baer, and all that it gives of the great inquirer's mind is intrinsically valuable and suggestive. T. J. McC.

GERBERT: UN PAPE PHILOSOPHE D'APRÈS L'HISTOIRE ET D'APRÈS LA LÉGENDE. By *F. Picavet.* Paris: Ernest Leroux. 1897. Pages, 227.

While the World's Parliament of Religions and its executive successor the Religious Parliament Extension have been long and faithfully laboring to carry home to the popular and clerical mind the necessity of the study of comparative religion, and great progress in academic circles in our country has been made in this direction, such an idea has found practical scientific realisation in a school of long-standing at Paris—the *Ecole des Hautes Etudes.* In this informal institution, which is devoted to research in its most advanced forms, there has existed for ten years a *Section of Religious Sciences* which offers opportunities for instruction that should satisfy the most exacting. And that its opportunities have not been neglected is evidenced by its attendance, which shows a total of 371, of whom 123 are foreigners.

The programme includes twelve seminary courses, exclusive of the optionals: (1) The Religions of the Uncivilised Peoples, by M. Marillier; (2) The Religions of the Farthermost Orient and of Indian America (China, Central America, etc.),

by M. Léon de Rosny; (3) The Religions of India, by M. Foucher; (4) The Religions of Egypt, by M. Amélineau; (5) Religions of Israel and the Occidental Semites, by M. Vernes; (6) Talmudic and Rabbinic Judaism, by M. Lévi; (7) Islam and the Religions of Arabia, by M. Derenbourg; (8) Religions of Greece and Rome, by M. Berthelot; (9) Christian Literature, by MM. Sabatier and De Faye; (10) History of Dogma, by MM. A. Réville and F. Picavet; (11) History of the Christian Church, by M. J. Réville; (12) History of Canon Law, by M. Esmein.

The school took its origin eleven years ago on the occasion of the abolition in France of the Catholic Faculties, and was the intellectual offspring of M. Liard, the Director of Higher Education. Its object is not propaganda, controversy, nor the arraignment of religions, but scientific inquiry exempt from theological passions; although as its founder well observes, if it is possible for impassioned controversies to arise in biological science we may be lenient with the zealous espousal of beliefs in religion which lies so much nearer our emotions. Still, contends he, it is possible to unite under the aegis of science the religious phenomena of the world; and that it is possible, the existence and flourishing condition of the school is proof.

Supplementing the work of the school are published important monographs by the professors and graduate scholars. Among these and constituting the ninth volume of the Series is the concise but exhaustive work on Gerbert, or Pope Sylvester II., by M. Picavet, *maître des conférences* for the history of dogma, an indefatigable student of medieval thought, whose publications we have had occasion to mention before.

The book *Gerbert* gives an altogether different picture of the Middle Ages than we are wont to take. Dark and despairing as these times were there were yet indications of slow progress, and *élite* minds who stood out as veritable saviours of the meagre civilisation that had survived the ruin of Rome. One of these last was Gerbert, monk, scholar, teacher, orator, philosopher, mathematician, pope, heretic Faust and Devil in one. Legend has woven about him a mighty and mysterious halo; but at the bottom are historical facts that make him the most striking figure of his century. He was a humanist, according to M. Picavet, surpassing the most eminent representatives of the Renaissance. Such was his political influence that it was said he made and unmade kings. From his researches in mathematics, D'Alembert said that had he lived in antiquity, he might have been the equal of Archimedes; or if later, says Picavet, perhaps the peer of Galileo. The invention of the Arabian numbers has been attributed to him; (he did in fact use empty spaces and columns for zeros;) while his reforms and great knowledge led to the belief of his irreligiousness and of his being in league with the Arch fiend himself.

M. Picavet has drawn well the leading features of the civilisation and thought of the tenth century. His work is not fragmentary and isolated, but shows the organic connexion of his subject with its historical past and its living environment. As for Gerbert, so M. Picavet has done the same work for Roscelinus, though on a

much smaller scale (the pamphlet, 26 pages, is in the same series, but published at the *Imprimerie Nationale*). Students of scholasticism should not fail to consult M. Picavet's brief and elegant studies. T. J. McC.

GENESIS OF THE SOCIAL CONSCIENCE. The Relation Between the Establishment of Christianity in Europe and the Social Question. By *H. S. Nash*, Professor in the Episcopal Theological School at Cambridge. New York: The Macmillan Company. Pages, viii–309. Price, $1.50.

This work may be characterised as a history of the development of the "individual," as seen in the changes undergone by the State, a kind of "pilgrim's progress," in which the soul aroused into activity by Christianity seeks and finally reaches the goal of her wanderings, the right of citizenship. It is not a story of any particular soul, and therefore it may be better to say, that the book is a prose epic on the rise and progress of the "common man." By this phrase is meant the elemental man who forms the material with which society is constructed, but who before the appearance of Christianity was so entirely subordinate to the State as not to have any "individuality." The theme which Professor Nash discusses is not new, but he has given it a new aspect by his philosophic treatment of the subject. He shows that, although the true worth of man as such had come to be recognised by the philosophers of Greece and Rome, it was not until God came to be conceived as "an Infinite Missionary Force in the service of the lowly" that the idea acquired much influence. The unity of God involves the moral unity of all classes of men, and hence "the idea of God becomes both the ideal and the task of mankind." The first six chapters of the work are devoted to the operation of Christian teaching in relation to the definition of man as "soul," and new light is thrown on the value of monastic life in connexion with the growth of that idea in its relation to social development. Monastic life was regarded as a return to a life of nature. It had its vows of poverty, and yet the dignity of hand-labor, which the ancients regarded as disgraceful, was insisted on. Moreover, the monastic system was based on the very ideas of freedom, equality, and fraternity which finally proclaimed themselves through Rousseau, and shook the world during the great French Revolution. These ideas bred of Christianity and nurtured in the monasteries had to make their way in the outside world, and Dr. Nash traces their progress, in combination with the idea of Duty, which is made explicit only through Christian teaching in relation to the Fall, until the "reformer's conscience" was developed. The eighteeth century was the "proving-ground" of the great conceptions which had so slowly grown. During this period the soul "entered the State," which now "receives its title direct from God and the sunshine," and which must work with the Church for the still further spread of the principle of "individuality." Dr. Nash writes "to be downright individual is to have a sturdy conviction that the potential is vastly greater than the actual; and this is the working conception of the infinite." It may be said to form also a key to his own work, as

with him individuality is at bottom merely the expression of the infinite. The book is a good addition to the literature of Christian socialism, and as a history of the gradual assertion of human *personality* it is of general interest. C. S. W.

L'Année Psychologique. Publiée par M. *Alfred Binet*. Avec la collaboration de MM. *H. Beaunis*, *Th. Ribot*, etc. Troisième Année. Paris: C. Reinwald. 1897.

The third issue of the *Année* opens with a brief article by Ribot on the "Abstraction of the Emotions," wherein this distinguished psychologist seeks to show that we analyse our emotional impressions and place certain representative features of them in relief, just as we do our sensory and intellectual impressions. A. Binet and J. Courtier contribute four exhaustive original researches in experimental psychology. N. Vaschide, V. Henri, and C. Henri are the other main original contributors. The department which epitomises and reviews the whole psychological work of the year 1896 is divided into sixteen parts, viz.: Histology, anatomy etc. of the nervous system, visual, auditive, tactual, gustatory, and olfactory sensations, memory and association, attention, perception and reasoning, illusion and hallucination, emotions, movements, language, individual psychology, dreams, etc., automatism, animal psychology, instruments, general treatises, etc. This department is complete and exhaustive, making the volume an indispensable reference-book of the year's doings in psychology. The indexes are full. In the bibliography 2234 titles are catalogued.

Allgemeine Physiologie. Ein Grundriss der Lehre vom Leben. Von *Max Verworn*, Dr. med. et phil., a. o. Professor der Physiologie an der medicinischen Facultät der Universität Jena. Zweite neu bearbeitete Auflage. Mit 285 Abbildungen. Jena: Verlag von Gustav Fischer. 1897. Price, 15 M.

In the preface to this excellent hand-book Dr. Verworn expresses his profound gratification at the favorable reception which the first edition met with, and has sought to retain the good will of the public by many new additions destined to keep his work abreast of the time, many new figures and considerable pruning of his old expositions. The work, which was originally a portly one in octavo, has been increased by some twenty odd pages, and it is especially noteworthy that the interest in its discussions has extended from the field of natural inquirers into that of students of medicine. The leading idea of Dr. Verworn's work is that the substratum of all elementary phenomena of life is the cell, and that hence in seeking an explanation of the phenomena of life physiology must explain the cell. General physiology, he says, can only be cellular physiology; the cell is the point to which all physiological researches have led and at which they have stopped; in it the secret of life is to be found. The book affords an exhaustive review of the elementary forms of life, and the elementary processes of life generally, and is profusely illustrated with diagrams, cuts of instruments, and drawings of the lower organisms.

THE ETHICS OF JOHN STUART MILL. Edited with Introductory Essays by *Charles Douglas, M. A., D. Sc.* Lecturer and Assistant in Moral Philosophy in the University of Edinburgh. Edinburgh and London: William Blackwood and Sons. 1897. Pages, cxxvi and 233. Price, 6 shillings net.

The reception accorded to Dr. Douglas's former work on the philosophy of John Stuart Mill offers a sufficient justification, were this needed, for the publication of the present volume, which deals particularly with Mr. Mill's ethical system. This forms so great an advance on the crude utilitarianism of Bentham, that its study is of great importance to those who would understand the bearings of modern hedonism. Dr. Douglas's present work is admirably adapted for the purposes of such study, for it not only reproduces from Mill's writings all that is required to obtain a perfect knowledge of his views, with an introductory Analysis to enable the reader to see clearly their most salient features, but it shows the influences which affected the development of Mill's ideas and points out where they are insufficient. The work is divided into two parts, the latter of which consists of Mill's "Utilitarianism," preceded by the chapters from his "System of Logic" in which that conception is developed, and the former of three Introductory Essays, followed by the Analysis. These Introductory Essays will naturally attract the most attention as giving the author's own opinions on Mill's system. They treat of "Ethics and Induction," "Ethics and Psychology," and "Ethics and Morality."

In the first named of these essays Dr. Douglas traces to its sources Mill's idea of an inductive science of character, which with him formed an important feature of political economy, as being the necessary basis of social science. Mill regarded society from the individual standpoint, instead of considering the individual from the point of view of society, as is now more usually accepted as the proper course. Hence a knowledge of individuals is essential, and it is not surprising that Mill was profoundly influenced by Hartley's Associationism and his related doctrine of Vibrations; although he was not prepared to accept the application of physiological principles for the explanation of mental states unless he was convinced that psychological analysis was not adequate to furnish it. Dr. Douglas does well to refer to Mill's dissatisfaction with the term "necessity" in relation to human conduct, which he rightly treated as simple determination by antecedents, volition not being otherwise bound.

In his second essay, Dr. Douglas deals with Mill's theory of morality, which he regards as marred by its dependence on a psychological conception of conduct. Ethology, the science of character, is treated by Mill as a branch or application of psychology, a view which renders such a result inevitable. As thus limited, no account can be taken of the internal or organic unity which constitutes the self, seeing that psychology is restricted to inference from the observed facts of mental life. Mill was aware, as Dr. Douglas points out, of the incompleteness of his account of mind, recognising that "the organic unity and continuity which characterise experience, and without which there would not be knowledge, depend upon the relation

of experience to a single knowing subject which is not a mere series of conscious states." And yet his psychological method prevented him from giving a proper basis to his system of ethics, and rendered his theory of volition incomplete. It does not allow sufficient account to be taken either of the unconscious factor which, as the expression of heredity, must largely affect the conduct, or of the personal life which exhibits itself in voluntary actions.

The ultimate problem of ethics is the discovery of the principle by which the moral judgment is determined, and Dr. Douglas in his essay on "Ethics and Morality" considers how far Mill was successful in dealing with it. By his assertion that pleasures vary in quality as well as in quantity, which is consistent with the higher position he assigns to virtue as a governing principle of human conduct, he provided a means of transforming earlier utilitarianism, the basis of which is changed when it is affirmed that the wise and the good know what *ought* to be liked. We are told that Mill's criticism of Bentham, which is given in the Appendix to the present volume, took its special form under the influence of Coleridge and Wordsworth and, at second hand, of German Idealism. While accepting Bentham's method, Mill rejected many of his opinions, his estimate of which may be formed from his statement, that "every human action has three aspects: its *moral* aspect, or that of its *right* and *wrong*; its *æsthetic* aspect, or that of its *beauty*; its *sympathetic* aspect, or that of its *lovableness*. The first addresses itself to our reason and conscience; the second to our imagination; the third to our human fellow-feeling. . . . Sentimentality consists in setting the last two of the three above the first; the error of moralists in general, and of Bentham, is to sink the two latter entirely." Surely Mill was not far from the truth; but he erred in viewing human action from too limited a standpoint. Conduct is right, beautiful and lovable, when it is in accordance with the principles of truth. Hence Mill's three aspects are merely different aspects of the true, and as truth is cosmical its sanctions must not be sought for merely in man himself. Nature works through man for the establishment of the principles of truth, which are eternal and are as consistent with human suffering as with human happiness. The aim of Nature is perfection in her works, and although on the broadest survey of her operations the greatest happiness of the greatest number will be found to prevail, yet at the furthest this can never be more than a *criterion* of conduct, the vital principle of which must always be truth. C. S. W.

THE MYTHS OF ISRAEL. The Ancient Book of Genesis with Analysis and Explanation of Its Composition. By *Amos Kidder Fiske*. New York: The Macmillan Company. 1897. Pages, x, 355. Price, $1.50.

Although the author of *The Myths of Israel* does not make claim to originality of investigation into the sources of what is usually termed Old Testament "history," he has done that without which originality in these days of criticism is of little value. He has studied the work of others in the same field for the purpose

of instruction, and then he has made an independent study of the subject by the light thus gained. In his previous work, *The Jewish Scriptures*, the author set forth his views of the Old Testament as a whole, and in the present one he applies them to its first book, that of Genesis, which is analysed and critically examined so that the manner of its production may be demonstrated. Mr. Fiske considers as established beyond dispute, that the first six books of the Jewish Scriptures were put into their present form after the return from the exile in Babylon, when the Levitical system of the second temple was developed, and that the greater part of matter of "Genesis" was taken from a Sacred History of the people compiled in the time of Hezekiah, near the end of the eighth century before Christ, from two older versions, of which one was composed in the Northern Kingdom and the other, half a century or more sooner, at Jerusalem. The first of these older versions, from which was derived much of the Book of Genesis, is that usually known as the Jehovistic narrative, from the use of the name Jehovah for the deity. The other version takes its title of the "Elohistic document" from its application to the deity of the word "Elohim" in the narrative, down to the revelation to Moses of the name Jehovah. When the two versions were blended the Judean scribe took the Elohistic narrative as the basis of his compilation, piecing into it passages from the other document, and occasionally introducing material from some other source. No better evidence of compilation need be required than the reference of the same incident—the beauty of the Hebrew woman attracting the attention of Abimelech, king of Gerar—to Sarah the wife of Abraham and long afterwards to Rebekah, the wife of Isaac. If the suggestion be well founded, that the story of Judah and his daughter-in-law Tamar was intended as a satire on the family of David, we have proof of the late origin of an important part of the present narrative, as well as evidence of the spirit which influenced the compiler. The author of *The Myths of Israel* may be congratulated not only on having written a very interesting book, but for the arrangment of his material, which is divided into parts, each division being preceded by a critical examination of its subject matter. The last chapter is entitled "The Unknown Homer of the Hebrews," that is, the Jehovist, whom the author supposes to have been a personality veiled behind the names of Elijah and Elisha, and is reprinted from *The New World*. C. S. W.

ANNOUNCEMENT.

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